NAVSHIPS 91521

INSTRUCTION BOOK

for

DIRECTION FINDER SET AN/URD-2A

BENDIX RADIO
DIVISION OF BENDIX AVIATION CORPORATION
BALTIMORE 4, MARYLAND

BUREAU OF SHIPS NAVY DEPARTMENT

ADDENDUM

TO

INSTRUCTION BOOK FOR DIRECTION FINDER SET AN/URD-2A (NAVSHIPS 91521)

1. Make the following changes in the Schematic Diagram and Wiring Diagram, adding resistor R166 (330K, 2W).

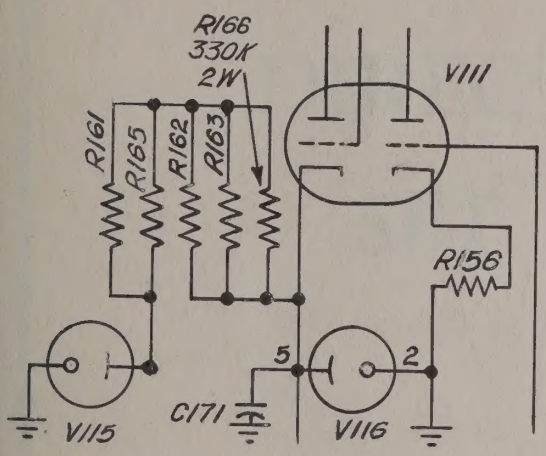

Figure 7-16. Schematic Diagram

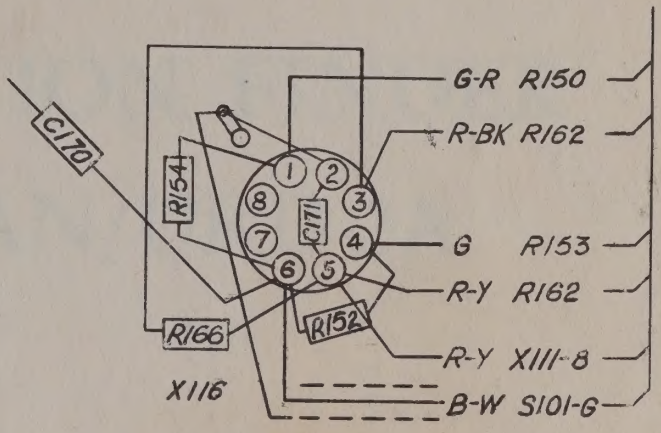

Figure 7-17. Wiring Diagram

2. Change page 1-3, paragraph 3e, to read as follows:

e. NUMBER OF PACKAGES INVOLVED PER COMPLETE SHIPMENT OF EQUIPMENT (including spare parts boxes) - Five.

3. Change page 1-5, Table 1-1, as follows:

QUANTITY PER EQUIPMENT AND NAME OF UNIT	NAVY TYPE DESIGNATION	OVERALL DIMENSIONS (IN.) A: CRATED B: UNCRATED	VOLUME (CU. IN.) A: CRATED B: UNCRATED	WEIGHT (LBS.) A: CRATED B: UNCRATED	BOX NO.
Repair Parts Box No. 1		A: 36 x 12 x 9	A: 3888	A: 43.5	5

Delete last two lines of table (boxes No. 6 and 7) completely.

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BUREAU OF SHIPS NAVY DEPARTMENT

Contract: NObsr-52081 *Approved by BuShips: 31 August 1951*

LIST OF EFFECTIVE PAGES

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
Title Page	Original	4–1 to 4–8	Original
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i to vii	Original	6–0 to 6–2	Original
1–0 to 1–6	Original	7–1 to 7–30	Original
2–1 to 2–15	Original	8–1 to 8–41	Original
3–0 to 3–16	Original		

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS
WASHINGTON 25, D. C.

IN REPLY REFER TO
Code 993-100
31 August 1951

From: Chief, Bureau of Ships
To: All Activities Concerned with the Installation, Operation and Maintenance of the Subject Equipment

Subj: Instruction Book for Radio Direction Finder Set AN/URD-2A NAVSHIPS 91521

1. This publication is the instruction book for the subject equipment and is in effect upon receipt.

2. When superseded by a later edition, this publication shall be destroyed.

3. Extracts from this publication may be made to facilitate the preparation of other Department of Defense Publications.

4. All Navy requests for NAVSHIPS Electronics publications should be directed to the nearest District Publications and Printing Office. When changes or revised books are distributed, notice will be included in the BUSHIPS ELECTRON and in the INDEX OF BUSHIPS GENERAL AND ELECTRONICS PUBLICATIONS, NAVSHIPS 250-020.

H. N. WALLIN
Chief of Bureau

RECORD OF CORRECTIONS MADE

CHANGE NO.	DATE	SIGNATURE OF OFFICER MAKING CORRECTION

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GUARANTEE

The equipment, including all parts and spare parts, except vacuum tubes, batteries, rubber and material normally consumed in operation, is guaranteed for a period of one year from the date of delivery of the equipment to and acceptance by the Government with the understanding that all such items found to be defective as to material, workmanship or manufacture will be repaired or replaced, f.o.b. any point within the continental limits of the United States designated by the Government, without delay and at no expense to the Government; provided that such guarantee will not obligate the Contractor to make repair or replacement of any such defective items unless the defect appears within the aforementioned period and the Contractor is notified thereof in writing within a reasonable time and the defect is not the result of normal expected shelf life deterioration.

To the extent the equipment, including all parts and spare parts, as defined above, is of the Contractor's design or is of a design selected by the Contractor, it is also guaranteed, subject to the foregoing conditions, against defects in design with the understanding that if ten per cent (10%) or more of any such said item, but not less than two of any such item, of the total quantity comprising such item furnished under the contract, are found to be defective as to design, such item will be conclusively presumed to be of defective design and subject to one hundred per cent (100%) correction or replacement by a suitably redesigned item.

All such defective items will be subject to ultimate return to the Contractor. In view of the fact that normal activities of the Naval Service may result in the use of equipment in such remote portions of the world or under such conditions as to preclude the return of the defective items for repair or replacement without jeopardizing the integrity of Naval communications, the exigencies of the Service, therefore, may necessitate expeditious repair of such items in order to prevent extended interruption of communications. In such cases the return of the defective items for examination by the Contractor prior to repair or replacement will not be mandatory. The report of a responsible authority, including details of the conditions surrounding the failure, will be acceptable as a basis for affecting expeditious adjustment under the provisions of this contractual guarantee.

The above one year period will not include any portion of time the equipment fails to perform satisfactorily due to any defects, and any items repaired or replaced by the Contractor will be guaranteed anew under this provision.

INSTALLATION RECORD

Contract Number NObsr–52081 Date of Contract, 28 November, 1950

Serial Number of equipment.....

Date of acceptance by the Navy.....

Date of delivery to contract destination.....

Date of completion of installation.....

Date placed in service.....

REPORT OF FAILURE

Report of a failure of any part of this equipment, during its entire service life, shall be made to the Bureau of Ships in accordance with current regulations using form NAVSHIPS NBS 383 (revised). The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failures see Chapter 67 of the *Bureau of Ships Manual* or superseding instructions.

ORDERING PARTS

All requests or requisitions for replacement material should include the following data:

1. Federal stock number or, when ordering from a Marine Corps or Signal Corps supply depot, the Signal Corps stock number.
2. Name and short description of part.

If the appropriate stock number is not available the following shall be specified:

1. Equipment model or type designation, circuit symbol, and item number.
2. Name of part and complete description.
3. Manufacturer's designation.
4. Contractor's drawing and part number.
5. JAN or Navy type number.

SAFETY NOTICE

The attention of officers and operating personnel is directed to Chapter 67 of the *Bureau of Ships Manual* or superseding instructions on the subject of radio-safety precautions to be observed.

This equipment employs voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working with the equipment.

While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS:

Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors. To avoid casualties always remove power and discharge and ground circuits prior to touching them.

DON'T TAMPER WITH INTERLOCKS:

Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS:

Do not depend upon door switches or interlocks for protection but always shut down motor generators or other power equipment. Under no circumstances should any access gate, door, or safety interlock switch be removed, short-circuited, or tampered with in any way, by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

HIGH-VOLTAGE MEASURING PROCEDURE

Voltages over 300 volts shall be measured as follows:

(1) De-energize the equipment. Ground terminals to be measured to discharge any capacitors connected to these terminals. (See Note F).

(2) Connect meter to terminals to be measured using a range higher than the expected voltage.

(3) WITHOUT TOUCHING METER OR TEST LEADS, energize the equipment and read the meter.

(4) De-energize the equipment. Ground the terminals connected to the meter before disconnecting meter.

Notes

(A) MAKE SURE you are NOT GROUNDED whenever you are adjusting equipment or using measuring equipment.

(B) In general, USE ONE HAND only when servicing live equipment.

(C) If test meter must be held or adjusted while voltage is applied GROUND the case of the meter before starting measurement and DO NOT touch the live equipment or personnel working on live equipment while you are holding the meter. Some moving vane type meters should not be grounded. These should not be held during measurements.

(D) DO NOT FORGET that high voltages MAY BE PRESENT across terminals that are normally low voltage, due to equipment breakdown. Be careful even when measuring low voltages.

(E) DO NOT use test equipment known to be in poor condition.

(F) High voltage high capacity capacitors should be discharged with a grounding stick with approximately 10 ohms in series with the grounded line. Where neither terminal of a capacitor is grounded, short capacitor terminals to each other.

RESUSCITATION

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR, OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

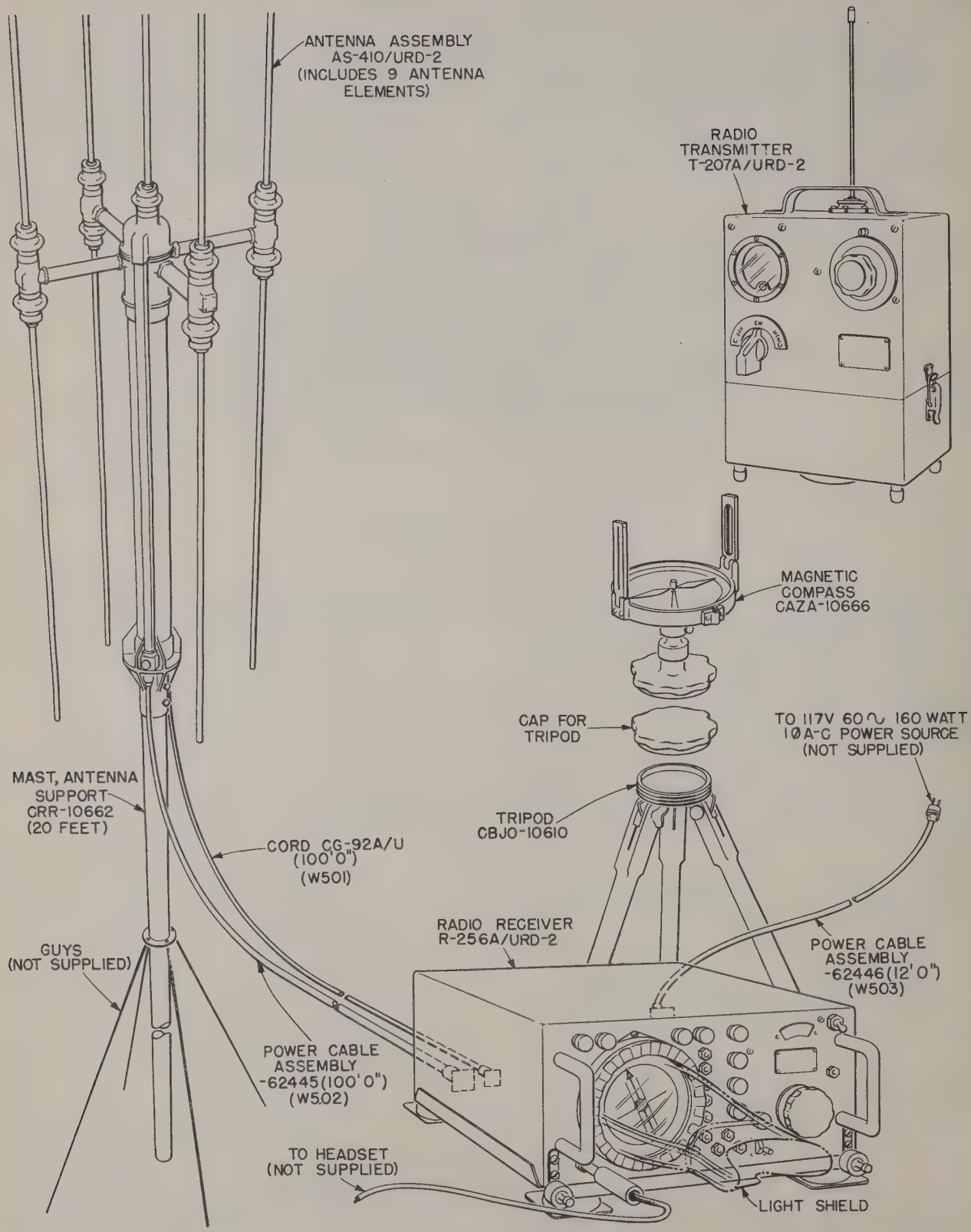


Figure 1–1. Direction Finder Set AN/URD–2A

SECTION 1
GENERAL DESCRIPTION

1. FUNCTION.

Direction Finder Set AN/URD–2A is for ship or shore use and operates in the frequency range of 100 mc to 156 mc. It provides instantaneous visual direction-finding information for r-f signals, whether unmodulated, amplitude modulated, or frequency modulated. Aural reception of any type of modulated signal also is provided.

The equipment consists of a fixed antenna assembly (including a rotating goniometer assembly), a receiver (including an indicator section and power supply for the system), a 20-foot mast (for mounting the antenna assembly), and necessary interconnecting cables and test equipment consisting of a target transmitter, a magnetic compass, and a tripod.

This direction finder set provides automatic visual indication of direction-of-arrival of received signals, whether unmodulated, amplitude, frequency, or phase modulated. It also provides aural reception of signals with any type of modulation, which may be had simultaneously with visual indication. The equipment is designed primarily for reception of vertically-polarized signals, but may be used on signals which are polarized as far as 45° from vertical. Bearing accuracy when the equipment is operated under these conditions is better than ±5 degrees.

The line-of-direction of a properly received r-f signal will automatically and instantaneously appear on the 5-inch cathode-ray tube face in the form of a pattern consisting of, or containing a propeller shape. The blades of the propeller will point to the line-of-direction of the received signals as indicated on the azimuth scale (compass scale) around the cathode-ray tube face. The sense of direction may be secured by operating a sense switch, which causes the shape of the pattern to change, removing the propeller-blade in the true direction.

Instead of using a rotating antenna, as many direction-finding systems do, this equipment uses a fixed antenna and a continuously rotating goniometer. At each revolution of the goniometer, direction-finding information is passed on to the cathode-ray tube. The goniometer rotates at sufficient speed to cause the direction-finding information to appear as a pattern (propeller-shaped) on the cathode-ray tube face. To compare this direction-finding system with the more common aural-null type of direction-finding system, the antenna produces results similar to a loop antenna which is rotated; and the two lobes of the propeller-shaped pattern on the cathode-ray tube face correspond to the two nulls received in 360° rotation of the loop antenna. A dual (ambiguous) bearing indication is common to any antenna which has a figure eight response pattern, such as a loop antenna or two pairs of dipole antennas such as are used in the AN/URD–2A system. However, the 180° ambiguity of the dual bearings is eliminated in the AN/URD–2A equipment by operation of a "sense" switch.

2. GENERAL DESCRIPTION OF UNITS.

a. ANTENNA ASSEMBLY AS–410/URD–2.—This assembly consists of goniometer with a crossarm bracket on top, into which the nine antenna elements are screwed (see figure 1–3). The bottom of the antenna assembly fits onto a 20-foot long metal mast (CRR–10662) when the equipment is installed (see figure 1–1). The goniometer housing is cast aluminum, cylindrically shaped. The antenna elements are stainless steel and are internally connected to the goniometer capacitors. R-f output from the goniometer is fed through a 100-foot length of coaxial cable to the receiver. A 100-foot long cable also connects the goniometer section and the receiver. The antenna section consists of a sense antenna and two pairs of *fixed* dipole, direction-finding antennas, each pair having a figure eight response pattern. The same antenna assembly is used for communications reception by the system. None of the antenna elements has to be rotated or adjusted in length.

Looking down on the antenna assembly from the top, it can be seen that the four dipole direction-finding antennas are located in the four corners of a square (see figure 1–3). The voltage from each pair of dipole antennas is applied to the stators of one of the two goniometer capacitors.

The goniometer section of the antenna assembly contains two goniometer capacitors which rotate continuously when the equipment is turned on (and the MOTOR ON-OFF switch is in the ON position), and receive voltages from both pairs of dipole antennas. The goniometer capacitors consist of specially shaped and very carefully machined stator and rotor plates which combine and sinewave modulate the voltages

from the antenna elements, and supply the resultant voltage to the receiver section. The goniometer section also contains a motor which drives both the goniometer capacitors and a generator located within the goniometer housing. The generator provides circular-sweep voltages to the cathode-ray tube in the indicator section of the receiver.

b. MAST, ANTENNA SUPPORT CRR–10662.— The mast is a 1.9-inch diameter aluminum cylinder which is 20 feet long. Approximately three feet from one end of the mast is a flange which contains four holes for guys (see figure 1–1). In installation, the antenna assembly is placed atop this mast (where it may be rotated for proper orientation) and the antenna assembly is secured by tightening the set screws in the collar on the bottom of the antenna assembly.

c. INTERCONNECTING CABLES. — The AN/-URD–2A system employs three cables (see figure 1–1), two between the receiver and antenna assembly and one from the receiver to a 117-volt, 60-cycle, single-phase, a-c power source. The three cables are as follows:

(1) CORD CG–92A/U.—The cable is an RG–9/U cable with a UG–21B/U plug on each end. This cable interconnects the antenna assembly and the receiver.

(2) INPUT POWER CABLE.—This cable is a two-conductor cable having a Navy type 491697 plug for connecting to a 117-volt, 60-cycle, single-phase, a-c source, and a type AN3106–22–4S plug for connection to the receiver.

(3) GONIOMETER POWER CABLE. — This cable is an eight-conductor cable having an AN3106–18–1S plug on one end and an AN3106–18–1P plug on the other end. This cable interconnects the receiver and goniometer to provide power for the goniometer, and circular sweep voltages for the receiver.

d. RADIO RECEIVER R–256A/URD–2.—The radio receiver (see figure 1–2) contains (1) a superheterodyne receiver which is manually tunable over one band which covers the frequency range of from 100 mc to 156 mc; (2) indicator circuits which present direction-finding information on the face of a 5-inch cathode-ray tube that is integral with the unit; and (3) a built-in power supply operated from a line voltage of 117-volts, 60-cycles, single-phase. The unit supplies automatic visual direction-finding information on the cathode-ray tube face, and, if the signal is voice or tone amplitude modulated, simultaneously supplies audio to a headset. The direction indication is in a form of a pattern consisting of, or containing a propeller shape on the cathode-ray tube. One of the lobes of the

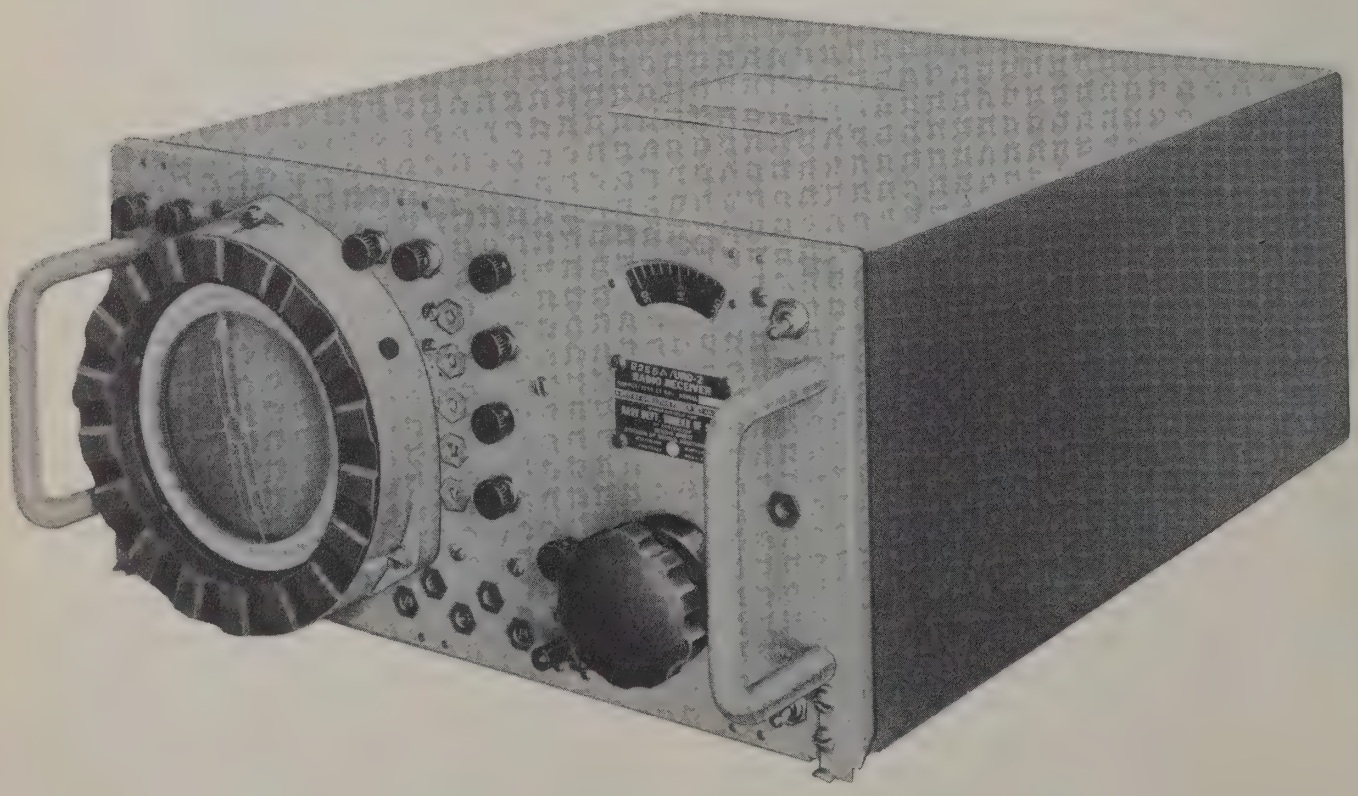


Figure 1–2. Radio Receiver R–256A/URD–2

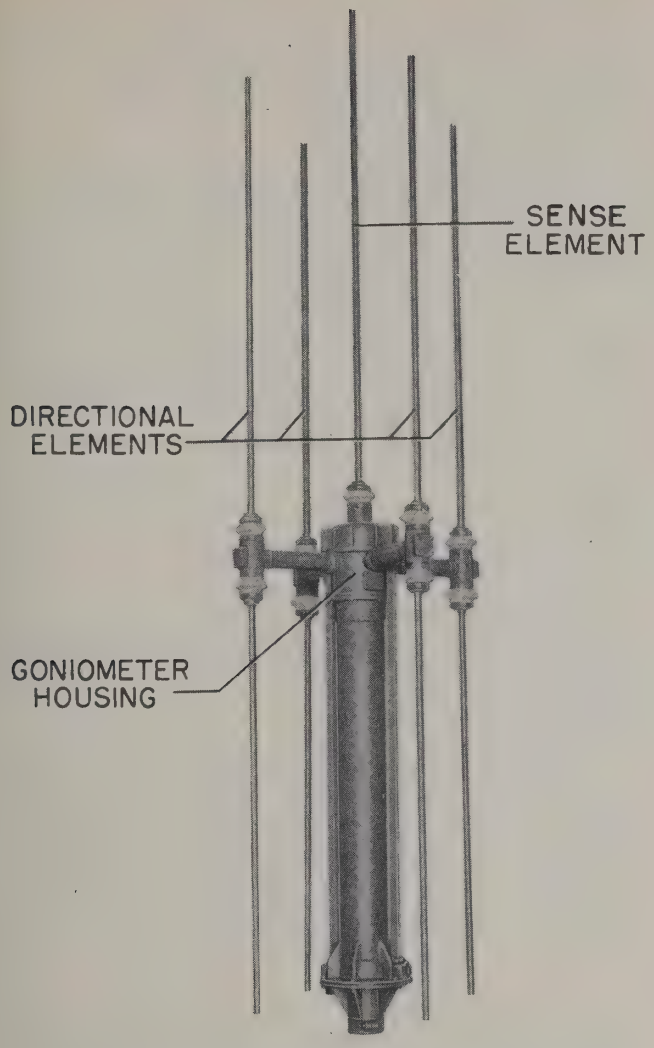


Figure 1–3. Antenna Assembly AS–410/URD–2

propeller shape points to the location of the transmitter which is emitting the r-f signal being received by the system, and the other lobe points to the opposite direction. True direction of the transmitter is identified by operation of a sense switch (CALIBRATE-SENSE switch).

The chassis is enclosed in a gray-wrinkle finish aluminum case and is mounted on a shockmount (1-1/2 ATR size) to which it is secured by thumbscrews. The headset jack (PHONES) and all operational and calibration adjustment controls are located on the front panel. The main tuning control is a large knob that rotates a lighted dial marked "MEGAGYCLES". The dial, calibrated to read directly in megacycles, is behind a front panel window. Those controls for adjustment of the patterns on the oscilloscope (cathode-ray tube) are grouped around the cathode-ray tube face and are operated by small push-to-turn knobs (which prevent unintentional moving of the controls), and screwdriver adjustment controls. The cathode-ray tube face is covered by a green filter for ease of reading even though direct light falls on the tube face (a sunshade also is supplied to facilitate viewing the screen in a strong light). The green filter has a cursor containing a selection arrow to be mechanically aligned with the propeller-shaped direction-finding pattern to aid in reading the bearing of the pattern. The 360° azimuth scale (compass scale) on which bearings are read is graduated every 2° and surrounds the cathode-ray tube face. It is illuminated by pilot lamps controlled by a dimmer control (LIGHTS control).

Eleven screwdriver adjustments which must be made only when other controls will not correct errors are located on the front panel.

All cable connections are made to connectors on the rear of the unit. Two fuse holders also are located on the rear of the unit. One contains the equipment fuse and the other contains a spare fuse.

e. TEST EQUIPMENT. — The test (calibration) equipment consists of Magnetic Compass CAZA–10666, Radio Transmitter T–207A/URD–2, and Tripod CBJO–10610 (see figure 1–4). The magnetic compass is used to position the radio transmitter at a location of known magnetic direction from the dipole antenna assembly. The radio transmitter provides test signals for installation calibration of the direction-finding system.

The radio transmitter has a telescoping antenna, which may be extended or retracted by manually moving in or out. When retracted, the antenna is protected by an internal tube. The transmitter is built in two sections; the upper section housing the radio transmitter and the lower containing the power supply which consists of one JAN–BA–65 (1.5-volt) battery and three JAN–BA–63 (45-volt) batteries. Transmitter controls, and a meter which indicates when the unit is operating are on the front of the case. The frequency range of the radio transmitter is continuously variable from 97 mc to 170 mc.

3. REFERENCE DATA.

a. NOMENCLATURE. — Direction Finder Set AN/URD–2A.

b. CONTRACT NUMBER AND DATE.—NObsr–52081 dated 28 November, 1950.

c. CONTRACTOR.—Bendix Radio Division, Bendix Aviation Corporation.

d. COGNIZANT NAVAL INSPECTOR.—Inspector of Naval Material, Baltimore, Md.

e. NUMBER OF PACKAGES INVOLVED PER COMPLETE SHIPMENT OF EQUIPMENT (including spare parts boxes.—Seven.

Figure 1–4. Transmitter T–207A/URD–2, Including Tripod and Compass

f. TOTAL CUBICAL CONTENTS.—Crated: 30,556 cu. in. Uncrated: 16,548 cu. in.

g. TOTAL WEIGHT. — Crated: 302.5 lbs. Uncrated: 129 lbs.

h. FREQUENCY RANGE.—100 mc to 156 mc (continuously variable).

i. NUMBER OF TUNING BANDS.—One.

j. NUMBER OF PRE-SET FREQUENCIES.—None.

k. TYPE OF RECEIVER.—Superheterodyne.

l. TYPE OF INDICATOR. — Cathode-ray tube (electrostatically deflected).

m. INTERMEDIATE FREQUENCY.—12 mc.

n. RECEIVER AUDIO OUTPUT.—200 milliwatts into 600-ohm impedance headset.

o. TYPE OF RECEPTION. — Direction-finding function on signals which are unmodulated, interrupted continuous wave, voice or tone amplitude modulated, or phase or frequency modulated. Simultaneous audio output for any voice or tone amplitude modulated signal.

p. CHARACTERISTICS OF POWER SUPPLY REQUIRED FOR OPERATION.—117 volts, 55-65 cycles, single-phase (150 volt-amperes).

q. POWER EQUIPMENT.—Ship's power supply or any source of 117 volts ± ten per cent (±10%), 55-65 cycles, single-phase, capable of supplying 150 volt-amperes continuously.

r. ELECTRICAL CHARACTERISTICS OF RECOMMENDED ANTENNAS. — Use only Antenna Assembly AS–410/URD–2 which is supplied as part of this direction-finding equipment. (Two pairs of half-wave Adcock direction-finding antennas, sense antenna, goniometer, sweep voltage generator, and motor.)

s. HEAT DISSIPATION OF RECEIVER. — 126 watts.

t. EQUIPMENT SUPPLIED WITH DIRECTION-FINDER SET AN/URD–2A.—Listed in table 1–1.

u. EQUIPMENT REQUIRED BUT NOT SUPPLIED WITH DIRECTION FINDER SET AN/URD–2A.—See table 1–2.

v. QUANTITY AND TYPE OF ELECTRON TUBES.—29 tubes. See table 1–3.

TABLE 1–1. EQUIPMENT SUPPLIED WITH DIRECTION FINDER SET AN/URD–2A

QUANTITY PER EQUIPMENT AND NAME OF UNIT	NAVY TYPE DESIGNATION	OVERALL DIMENSIONS (IN.) A: CRATED B: UNCRATED	VOLUME (CU. IN.) A: CRATED B: UNCRATED	WEIGHT (LBS.) A: CRATED B: UNCRATED	BOX NO.
1—Receiver (including shockmount) Instruction Books, Field Test Data, and Repair Parts List included in this box.	R–256A/URD–2	A: 31x19x13-1/2 B: 24-1/2x16-7/8x9-5/8	A: 7950 B: 3865	A: 116 B: 55	1
1—Antenna Assembly consisting of:	AS–410/URD–2	A: 47-1/2x19x19 B: 40-3/32x14-25/32x 14-25/32	A: 17,000 B: 9700	A: 115 B: 33	2
1—Antenna Assembly		A: * B: 40-3/32x14-25/32x 14-25/32	A: * B: 9700	A: * B: 27.5	
9—Antenna Elements		A: * B: 34x1/2 dia.	A: * B: 8	A: * B: 0.5 each	
1—Radio Transmitter consisting of:	T–207A/URD–2	A: 25x19x21 B: 9x6-15/16x12	A: 10,022 B: 770	A: 102 B: 11	3
1—Transmitter		A: * B: 9x6-15/16x12	A: * B: 770	A: * B: 4	
1—Light Shield	N203832–1	A: * B: 10-7/8x7 dia.	A: * B: 420	A: * B: 5	
1—Magnetic Compass	CAZA–10666	A: * B: 4-3/8x5-11/16 dia.	A: * B: 143	A: * B: 2	
1—Antenna Cable consisting of:	CG–92A/U	A: *	A: *	A: *	
2—Plugs	UG–21B/U				
1—Cord	RG–9/U				
1—Goniometer Power Cable consisting of:	–62445	A: *	A: *	A: *	
1—Plug	AN3106–20–7PA				
1—Plug	AN3106–20–7SA				
1—Cable	TTRS–4				
1—Input Power Cable	–62446	A: *	A: *	A: *	
1—Plug	491697				
1—Plug	AN3106A–22–4S				
1—Cable					
1—Mast, Antenna Support	CRR–10662	A: 129x6x8 B: 20 ft. x 1.9 dia. Flange 3.75 dia.	A: 6220 B: 960	A: 70 B: 20	4
1—Tripod	CBJO–10610	A: * B: 4-1/4x4-1/4x60	A: * B: 1110	A: * B: 8	
Repair Parts Box #1		A: 29-1/2x18-1/2x17-1/2	A: 9552	A: 120	5
Repair Parts Box #2		A: 41-1/2x18x17	A: 12,699	A: 160	6
Repair Parts Box #3		A: 24x12x21-1/2	A: 6192	A: 40	7

* Packed in same carton with major assembly.

TABLE 1–2. EQUIPMENT REQUIRED BUT NOT SUPPLIED WITH DIRECTION FINDER SET AN/URD–2A

QUANTITY PER EQUIPMENT	NAME OF UNIT	NAVY TYPE DESIGNATION	REQUIRED CHARACTERISTICS
1	Headset	–49016	With cord and plug. 600-ohm impedance.
4	Guys		For mast. Depends upon installation requirements.
	Power Source		117v, 60-cycle, single-phase, 150 volt-amperes.
1	Battery	JAN–BA–65	1.5-volts, dc
3	Battery	JAN–BA–63	45-volts, dc

TABLE 1–3. QUANTITY AND TYPE OF ELECTRON TUBES

QUANTITY USED		NAVY TYPE OF ELECTRON TUBE	QUANTITY USED		NAVY TYPE OF ELECTRON TUBE
RADIO RECEIVER R–256A/URD–2	RADIO TRANSMITTER T–207A/URD–2		RADIO RECEIVER R–256A/URD–2	RADIO TRANSMITTER T–207A/URD–2	
	1	JAN–3A5	2		JAN–5651
10		JAN–2C51	1		JAN–1B3GT
1		JAN–5CP1A	1		JAN–VR75
1		JAN–5R4GY	1		JAN–BR105
10		JAN–6AS6	1		1H–4B
1		JAN–6Y6G			

SECTION 2
THEORY OF OPERATION

1. GENERAL THEORY OF OPERATION.

a. COMPOSITION OF SYSTEM.—Direction Finder Set AN/URD–2A uses an antenna system which is not rotatable, a continuously rotating goniometer, and a receiver consisting of a power supply, a superheterodyne receiver, and an indicator with a 5-inch cathode-ray tube (see figure 2–2). A two-phase alternator, which supplies circular sweep voltages to the indicator, and a tone-wheel, which supplies calibration voltages, are mounted on the same shaft as the goniometer so that all (motor, goniometer, tone-wheel, and alternator) are in synchronism (see figure 2–2). Power for the entire equipment is obtained through the power supply section of the receiver. The source of this power is any 117-volt, 60-cycle, single-phase line.

b. FORM OF DIRECTION-FINDING INFORMATION.—When the equipment is turned on and the receiver section is tuned to the frequency of an incoming r-f signal, a propeller-shaped pattern (or a pattern containing a propeller shape) immediately appears on the cathode-ray tube. (See A of figure 2–1.) One blade of the propeller shape points to the true, and the other blade to the reciprocal bearing of the received signal as read on an azimuth scale which is around the face of the cathode-ray tube. The true and reciprocal bearings are on the line-of-direction of the received signal (180° apart as read on the azimuth scale). Means are provided for the determination of which bearing is the true bearing or angle of arrival of the received signal. When the sense (CALIBRATE-SENSE) switch (located on the front panel of the receiver) is placed in the SENSE position, the propeller-blade pattern changes shape to indicate the true-bearing direction (see B of figure 2–1). The indicated bearing may be a true or magnetic bearing in a shore installation where the direction-finding system is so oriented that "O" on the azimuth scale corresponds to either true or magnetic North. In shipboard installations where the system is so oriented that the "O" on the scale corresponds to the ship's heading, readings are relative to the ship's heading.

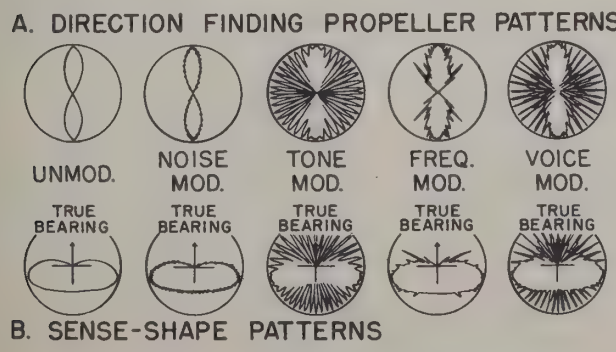


Figure 2–1. Typical Sense and D/F Patterns

2. DEVELOPMENT OF PATTERNS.

a. CIRCULAR PATTERN. — With the POWER ON-OFF switch in the ON position, the MOTOR ON-OFF switch in the ON position, and with no signal

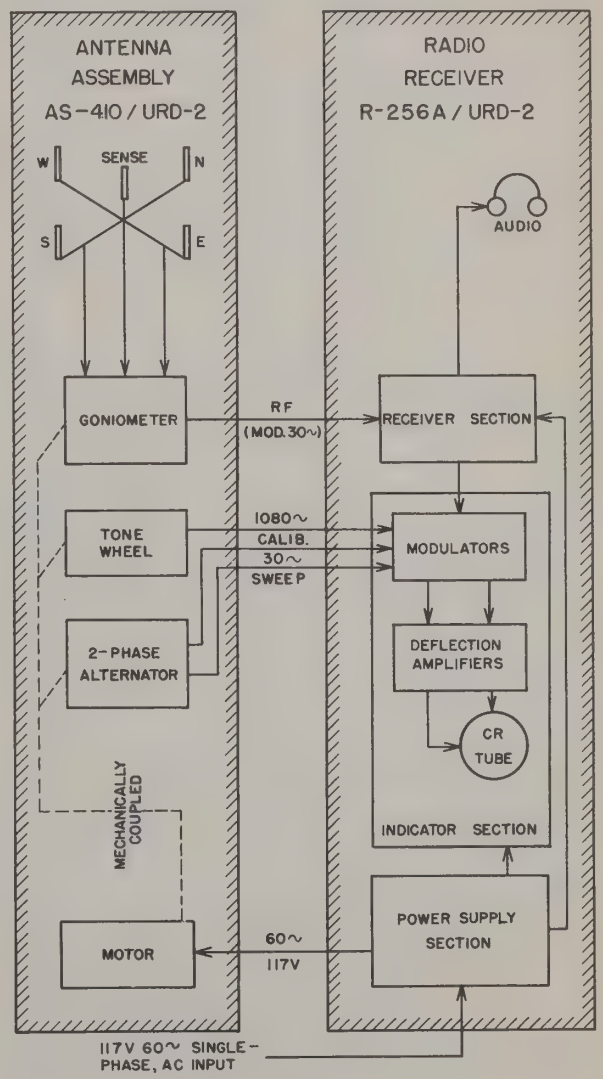


Figure 2–2. Direction Finder Set AN/URD–2A, Block Diagram

being received, a circular pattern will appear on the cathode-ray tube face. This circular pattern is produced as follows:

Placing the MOTOR ON-OFF switch in the ON position starts the motor in the antenna. The motor turns the shaft to which the goniometer, tone-wheel and alternator are coupled. The alternator is rotated at a rate of 30 rps to produce two 6-volt, 30-cps, a-c outputs which are 90° out of phase. These two outputs from the alternator are fed to the modulators (V117, V118, V119, and V120) through pins A, B, F, and G of receptacle J104 of the receiver. These 90° out-of-phase sinusoidal sweep voltages are amplified (V123 and V124) and applied to the deflection plates of the cathode-ray tube (V127).

Figure 2–3 shows how the sweep voltages produce a circular pattern. The vertical sweep voltage (M of figure 2–3) moves the electron stream down and up at the same rate and time that the horizontal sweep voltage (P of figure 2–3) moves the electron stream from center, to the right, to the left, and back to center. The result is a circle. Each number on the circular pattern represents the same instant of time as the same number on the sweep voltages (M and P of figure 2–3) and the modulation (K of figure 2–3). Because no signals (r-f or calibration) are being received, the sweep voltages are not modulated (K of figure 2–3) and the pattern on the screen is a circle.

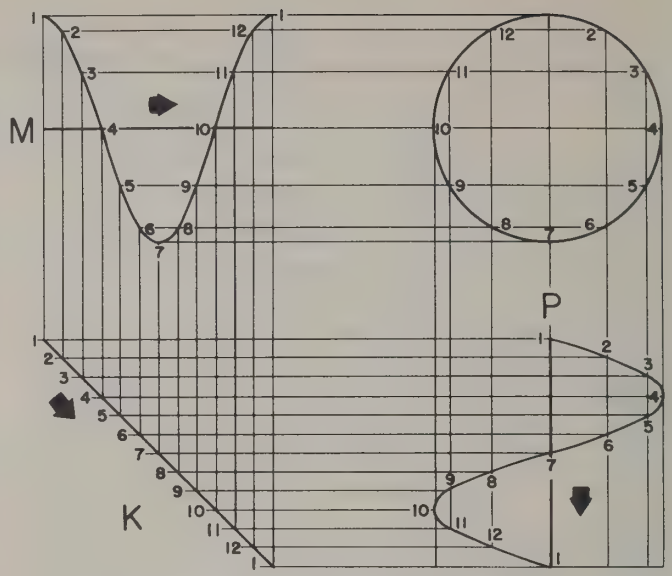

M
P
K
M = VERTICAL DEFLECTION VOLTAGE
P = HORIZONTAL DEFLECTION VOLTAGE
K = MODULATION (NONE WITH CIRCULAR NO-SIGNAL PATTERN)
= TIME (EACH NO. = 1/360 SEC.)

Figure 2–3. Development of Circular Pattern

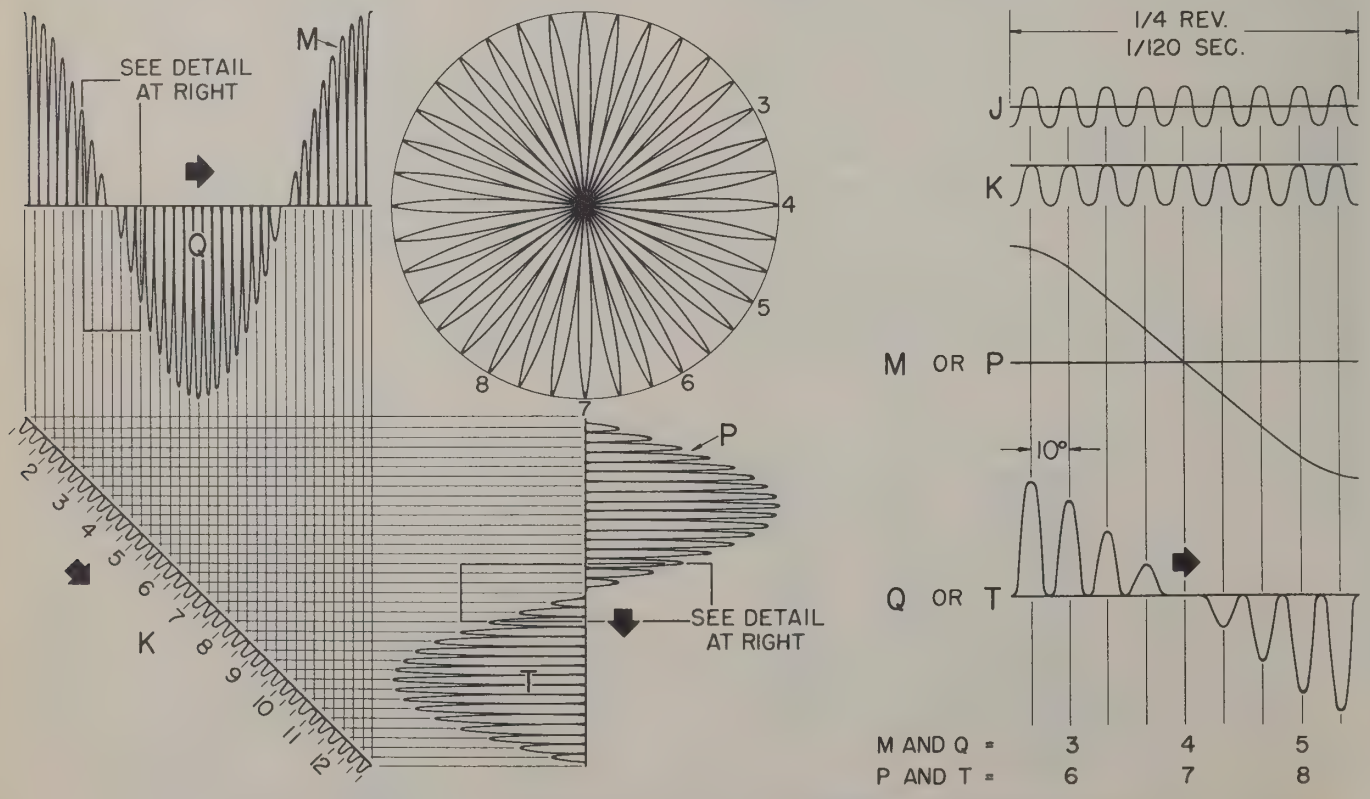


Figure 2–4. Development of 36-Lobe Calibration Pattern

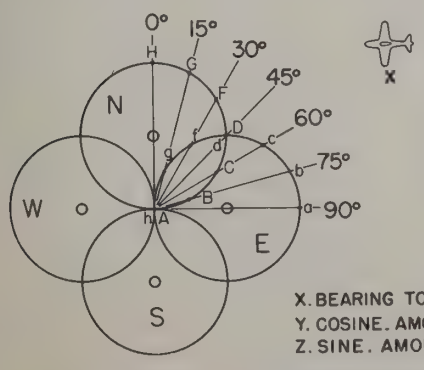
b. CALIBRATION PATTERN. — If the CALIBRATE-SENSE switch is placed in the CALIBRATE position, the circular pattern will be replaced by a 36-lobe calibration pattern. This 36-lobe pattern is developed in the following manner:

The tone-wheel is rotated by the motor at the rate of 30 rps to produce a 1/4-volt, 1080-cps a-c output which is fed through pins C and H of J104 to one section of V111. The amplified output of V111 is fed through CALIBRATE-SENSE switch S101F to the grids of the modulators (V117, V118, V119, and V120) to cut off the sweep voltages 1080 times each second (or 36 times each revolution of the circular sweep) and to produce a "daisy"-shaped pattern with points spaced at 10° intervals around the screen.

Figure 2–4 shows how the calibration signal modulates the sweep voltages (or how the sweep voltages modulate the calibration signal). In figure 2–4, J is the calibration signal, K is the modulation, M and P are the vertical and horizontal sweep voltages, and Q and T are the resultant combined voltages appearing on the deflection plates of the cathode-ray tube. Each number on any waveform and on the pattern represents the same instant of time as the same number on the other waveforms.

c. DIRECTION FINDING PATTERN.—With the CALIBRATE-SENSE at center (off), the MOTOR ON-OFF and POWER ON-OFF at ON, and an r-f signal tuned in on the receiver, a pattern consisting of, or containing a propeller shape, will appear on the face of the cathode-ray tube. This propeller shape is produced as follows:

Consider that an r-f signal is being received by the antenna system which consists of two pairs of Adcock antennas, cross connected, and fixed in position with the axes of the two pairs at right angles. Each pair of antennas has a figure eight response pattern (see N-S and E-W of figure 2–5). From figure 2–5, it can be seen that with the r-f voltage and the E-W pair North (H or 0° of figure 2–5), the N-S pair of antennas receives maximum r-f voltage and the E-W pair receives no voltage. Likewise, if the signal is from the East (A or 90° of figure 2–5), the E-W pair receives maximum and the N-S pair receives no voltage. With the signal at a point between North and East, the N-S pair will receive an amount which is proportional to the *cosine* of the (h-H of figure 2–5) amount received with the signal from the North; and the E-W pair will receive an amount which is proportional to the *sine* of the (h-H of figure 2–5) amount received with the signal from the North. The table in figure 2–5 shows these cosine (Y) and sine (Z) values at various signal sources.



	N-S ANT		E-W ANT	
X		Y		Z
0°	H	1.000	h	0
15°	G	.965	g	.259
30°	F	.866	f	.500
45°	D	.707	d	.707
60°	C	.500	c	.866
75°	B	.259	b	.965
90°	A	0	a	1.000

X. BEARING TO SIGNAL SOURCE
Y. COSINE. AMOUNT FROM CENTER
Z. SINE. AMOUNT FROM CENTER

Figure 2–5. Antenna RF Signal Voltages

As shown in figure 2–5, the angle of arrival of the incoming signal can be determined from a comparison of the r-f voltage received by each pair of antennas. If the levels of r-f voltage in the two pairs of antennas are sinewave modulated 90° out-of-phase and combined, the location of the two zero voltage points on the resultant sinewave indicates true and reciprocal bearings (line of direction) of the received signal. This is accomplished as shown in figure 2–6 and as hereafter described.

In this system, a capacitive goniometer combines and sinewave modulates the r-f voltages. The goniometer is a rotating device which samples this r-f voltage from each pair of antennas at exactly the frequency (30 cps) of the alternator sweep voltage. Because of the high frequency at which this equipment operates, the goniometer is a capacitive one, consisting of two sets of stators physically located at a 90° angle with respect to each other, and two sets of rotors on a single shaft. The r-f voltage from each pair of antennas is applied to one set of stators and sinewave modulated by the two sets of rotors which are driven by the motor. The 90° out-of-phase sinewave voltages from the two sets of rotors are combined and fed to the input of the receiver through J101. Figure 2–6 shows these waveforms with an r-f signal source at 60°. In figure 2–6, A is the r-f voltage from the N-S antennas (whose proportional voltage is 50 per cent), B is the r-f voltage from the E-W antennas (whose proportional voltage is 86.6 per cent), C is the 30-cps modulated voltage from the N-S antennas, D is the 30-cps modulated voltage from the E-W antennas, and F is the resultant combined N-S and E-W modulated voltages. Each number represents 1/360 second and consequently 1/12 revolution or 30°. The following list shows how the wave shape of the output from the goniometer (F of figure 2–6) is developed so that the zero voltage point (null) occurs at 60°.

Because the CALIBRATE-SENSE switch is in the center position, no sense antenna voltage (G of figure 2–6) is added to the combined voltage (F of figure 2–6) and the input (H of figure 2–6) to the receiver is

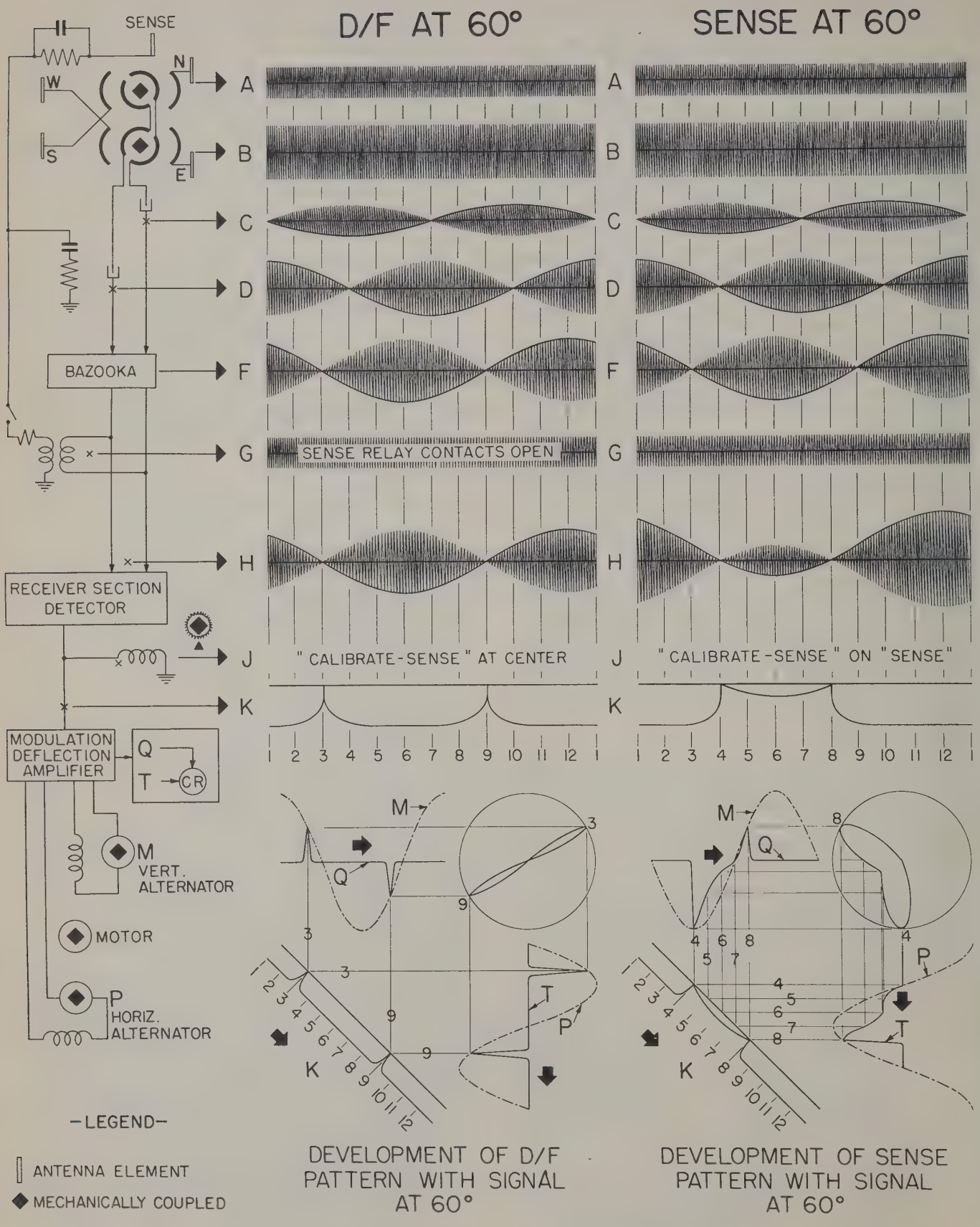


Figure 2–6. Development of Direction Finding and Sense Patterns

GONIOMETER ROTATION	TIME (NO. OF FIG. 2–6)	N-S ANT. VOLTAGE (C OF FIG. 2–6)	E-W ANT. VOLTAGE (D OF FIG. 2–6)	COMBINED VOLTAGE (F OF FIG. 2–6)
0°	1	0	+86.6	+86.6
30°	2	−25.0	+75.0	+50.0
60°	3	−43.3	+43.3	0
90°	4	−50.0	0	−50.0
120°	5	−43.3	−43.3	−86.6
150°	6	−25.0	−75.0	−100.0
180°	7	0	−86.6	−86.6
210°	8	+25.0	−75.0	−50.0
240°	9	+43.3	−43.3	0
270°	10	+50.0	0	+50.0
300°	11	+43.3	+43.3	+86.6
330°	12	+25.0	+75.0	+100.0
360°	1	0	+86.6	+86.6

the same as the combined N-S and E-W voltage (F of figure 2–6).

The zero voltage points (nulls) of this combined voltage (H of figure 2–6) represent the true and reciprocal bearings of the signal and are converted into visual direction-finding information as follows: Between zero voltage points, the negative modulator bias voltage (K of figure 2–6) cuts off the modulator tubes so that the vertical (M of figure 2–6) and horizontal (P of figure 2–6) sweep voltages do not reach the cathode-ray tube. Although the circular sweep voltages are blocked from the deflection plates of the cathode-ray tube they are still changing phase in synchronism with the modulating voltage (H of figure 2–6) because the goniometer and alternator are on the same shaft. Each zero voltage point (3 and 9 on H and K of figure 2–6) allows the modulators to conduct and so the spot (which was at the center of the screen during cut-off) travels toward the edge of the screen in the direction determined by the relative amplitudes and polarity at the instant of the null (note the composite waveforms Q and T at time 3). By the time the spot reaches the edge of the tube face, the null will have passed, and the negative voltage will again be applied to cut off the modulators. The spot then returns to the center of the screen (composite waveforms Q and T at time 4 of figure 2–6). This completes one blade of the propeller pattern. Since the zero voltage points are 180° apart, by the time the second null reaches the modulator (9 of figure 2–6), the sweep voltage also will have changed 180° in phase and the second blade will appear opposite the first blade on the screen. The goniometer and alternator frequencies are sufficiently rapid and the cathode-ray tube screen is sufficiently persistent for the propeller-shaped pattern to appear on the screen almost instantaneously and to appear to be fixed as long as the r-f signal is being received. If the signal is being transmitted from a moving aircraft, the propeller-shaped pattern can be seen to move around the screen as the angle between the aircraft and the reference point changes.

d. SENSE PATTERN.—The propeller-shaped pattern points to both the true and reciprocal bearing (60° and 240° in figure 2–6). The system overcomes this 180° ambiguity, which is an undesirable by-product of the figure-of-eight antenna pattern, by the use of an open vertical sense antenna located symmetrically in the center of the four antennas. The sense antenna is not directional but is equally sensitive to voltages from all directions. When the sense (CALIBRATE-SENSE) switch is in the SENSE position, the sense voltage (G of figure 2–6) is added to the goniometer voltage (F of figure 2–6) resulting in an output voltage (H of figure 2–6) in which the zero points are relocated so that the point between the new zero points will be 90° from the zero points of the goniometer voltage. The amount of separation between these new zero points (H of figure 2–6) will depend upon the amount of sense voltage. The development of these new zero points is shown in the following list.

GONIOMETER ROTATION	TIME (NO. OF FIG. 2–6)	GONIOMETER VOLTAGE (F OF FIG. 2–6)	SENSE ANTENNA VOLTAGE (G OF FIG. 2–6)	COMBINED OUTPUT VOLTAGE (H OF FIG. 2–6)
0°	1	+86.6	+50.0	+136.6
30°	2	+50.0	+50.0	+100.0
60°	3	0	+50.0	+50.0
90°	4	−50.0	+50.0	0
120°	5	−86.6	+50.0	−36.6
150°	6	−100.0	+50.0	−50.0
180°	7	−86.6	+50.0	−36.6
210°	8	−50.0	+50.0	0
240°	9	0	+50.0	+50.0
270°	10	+50.0	+50.0	+100.0
300°	11	+86.6	+50.0	+136.6
330°	12	+100.0	+50.0	+150.0
360°	1	+86.6	+50.0	+136.6

The sense switch also transposes the circular sweep voltages to make this new input to the receiver occur at the position of the reciprocal bearing. The difference between the receiver input voltage (H), the resultant modulation (K), the vertical and horizontal sweep voltages (M and P), the resultant modulation of the sweep voltages (Q and T), and the development of the patterns are shown by comparing the "D/F AT 60°" with the "SENSE AT 60°" portions of figure 2–6.

It may be noted from a study of figure 2–6 that the voltage to the receiver (H) and consequently the modulation bias (K), does not completely cut off the modulators during the period between the zero points. This results in a pattern whose shape will vary from the (ideal) bent-propeller shape, through "kidney" and "cardiod" shapes, to a small circular shape, depending upon the relative amplitude of the sense voltage (determined by the components in the sense circuit).

e. PATTERN DISTORTIONS. — The propeller shape and sense patterns will vary from the ideal patterns when distortions are added to the waveshapes. These distortions may be due to voice, tone, noise, or frequency modulation of the carrier; to unsymmetrical antenna placement; or to unbalance in the receiver circuits. The modulation of the carrier will tend to be reproduced along the edge of the pattern with the amount of modulation (the amplitude at an instant of time) being the amount the electron stream deviates from the pattern (at that instant of time) and the frequency of modulation represented by the number of times the electron stream deviates from the pattern. For instance, if the received r-f signal were 100 per cent modulated by a 1200-cps tone, it can be seen that the pattern would be composed of 40 (1200 ÷ 30) lines radiating out from and returning to the D/F or sense shape (see "TONE MOD." of figure 2–1). And, if that modulation had been due to voice, those deviations would have been complicated by varying amplitudes and the presence of (not 100 per cent modulated) harmonics (see "VOICE MOD." and "FREQ. MOD." of figure 2–1). A bent propeller-blade pattern will result from unequal outputs from a pair of antennas when the antenna elements are not an equal distance from the housing. Unbalancing of the circuits will cause distortion due to unequal amplification of the voltages which operate the deflection plates. These various distortions are partially or completely compensated for by means of the circuits and controls discussed in the detailed description of circuits.

3. DETAILED DESCRIPTION OF CIRCUITS.

a. RECEIVER SECTION.—The receiver section is a superhetrodyne receiver which is manually tunable over the 100 to 156-mc range. Audio amplification and a headset jack for the audio output are provided for monitoring signals which are amplitude modulated by either voice or tone. Second detector video output of signals, either modulated or unmodulated, is applied to the indicator section for visual direction-finding information. The receiver has delayed automatic volume control.

(1) R-F STAGE.—The receiver uses one stage of r-f, a 6AS6 (V101), with both grid and plate resonated to the incoming signal. The modified Hartley oscillator, using a 6AS6 (V102), tunes from 44 to 72 mc.

The r-f signal and the oscillator, which is 12 mc lower in frequency than the rf, are electronically mixed in the 2C51 (V103) mixer. The mixer plate circuit is the primary of the last i-f transformer, Z101.

The r-f stage grid tuning capacitor C101-C, the r-f plate tuning capacitor C101-D, and the mixer grid tuning capacitor C101-E are ganged. The oscillator tuning capacitor C111-B is connected to the three-gang capacitor C101 by means of anti-backlash gears, and all these tuning capacitors are driven by the main tuning control, a large knob on the front panel which rotates a lighted tuning dial marked "MEGACYCLES". The tuned circuits just mentioned are made to track properly by alignment adjustment of a trimmer capacitor across each resonant circuit (see schematic figure 7–16). Because of the high frequency, the coils of the r-f section are only one or two turns of wire and are self-supporting.

(2) I-F STAGES.—The receiver section has four i-f stages (shown in figure 2–10) using 6AS6 tubes (V104, V105, V106, and V107). The intermediate frequency is 12 mc. The five i-f transformers are permeability tuned and are overcoupled. The overall bandpass response curve is 150 kc wide, providing good selectivity and a bandpass sufficiently wide so that the receiver will remain in tune despite small variations that may occur in incoming signal frequencies or on the oscillator.

(3) AVC AND R-F SENS. CONTROL.—The avc and bias circuits are shown in figure 2–7. Since the R-F SENSitivity potentiometer is in series with the grids of the r-f and i-f tubes and ground, it provides the bias for these tubes. However, the mixer, V103, has its own system of bias resistors, as does the fourth i-f amplifier, V107. The signal is rectified by the avc section of 2C51 tube V108, and the avc voltage is developed across the avc load resistor R128. It is filtered for r-f by resistor R127 and capacitor C153.

The avc half of V108 is so designed that, when the signal at its grid exceeds a certain preset value (about 5 volts), the avc operates. When this happens, additional bias is provided by the avc to decrease the gain through the system so that there is a slower rate of increase of signal voltages to the detector.

In order that the rectified 30-cycle signal from the antenna (60-cycle pulsating dc after rectification) does not modulate the r-f and i-f stages through the avc voltage, a filter consisting of R119, C194, C142, and R239 is used in the avc line. This is a "bridged-T" network which is peaked at 60 cycles and attenuates that frequency sufficiently to remove all traces of it from the signal.

b. NOISE COMPENSATOR.—The signal is rectified by the detector half of V108 and appears across R124. This pulsating d-c voltage is applied to the modulator tubes to cut off the sweep voltages, described in Section 2, paragraph 2*c*. If this signal were noise-free, the waveshape would be correct and the pattern would touch the edge of the screen (see pattern D of figure 2–8). However, since the output contains both signal and noise, the waveshape is distorted so that the desired 30-cycle component does not reach zero, and, consequently the lobes do not touch the edge of the screen (see pattern E of figure 2–8).

This same effect would be had by changing the bias

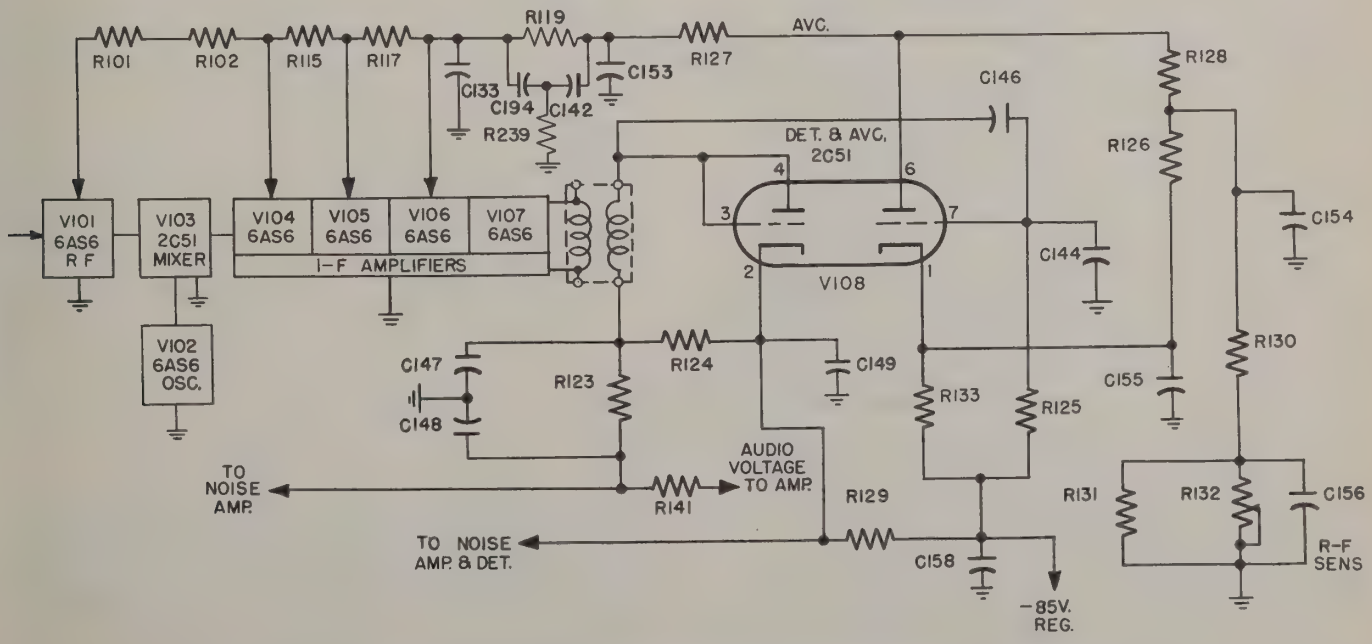


Figure 2–7. Radio Receiver R–256A/URD–2, R.F. SENS. Control, AVC and Bias

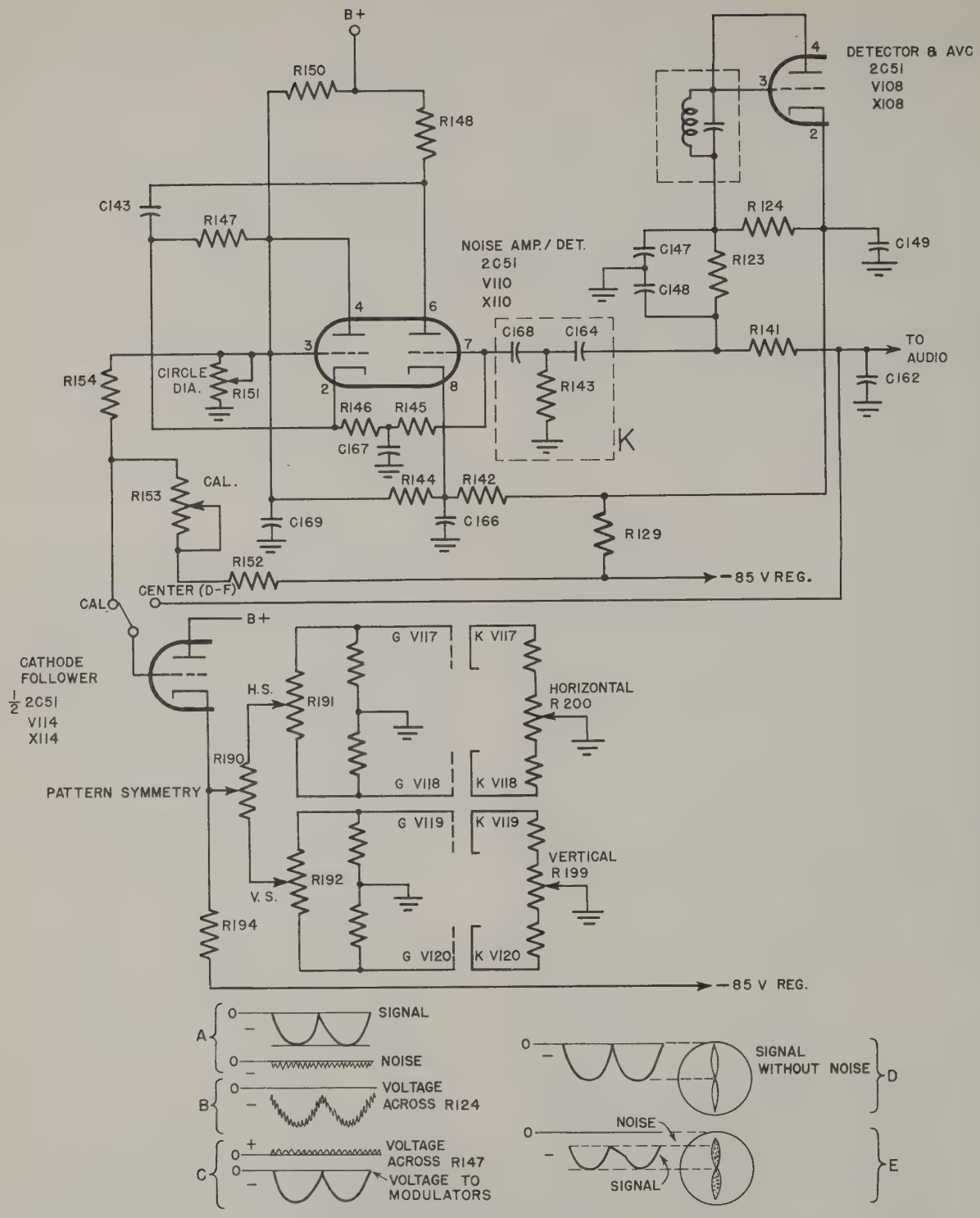


Figure 2–8. Radio Receiver R–256A/URD–2, Noise Compensator Circuit Schematic

by means of the CIRCLE DIA. potentiometer. The noise compensator circuit counteracts this effect in the following manner.

At K (figure 2–8), a filter system designed to pass noise frequencies on the order of 10-kc feeds pulsating d-c noise voltage to the 2C51 noise amplifier—cathode follower, V110. It is rectified by the diode-connected second half of V110 and appears across R147, then across R146 and C167, as a positive d-c voltage. The grid of the cathode follower receives this positive dc through R145, which increases the cathode current in the amplifier half, and consequently, causes the

potential through the cathode follower output resistor, R144, to change.

This change in voltage is reflected through the biasing system (R151, R154, R153, R152, and R129) until it is applied to the cathode of V108. Here it raises the bias level to provide a positive voltage equal to the negative d-c component of noise voltage.

Thus, the effect of noise is nullified by the noise compensator.

c. P.S. CONTROL.—The detector output is applied through controls to the control grids and the sweep voltages are applied to the suppressor grids of the modulator tubes. Because of differences in tubes, one set of modulators might modulate the sweep voltages to a greater extent than the other set of modulators and the result would be a pattern which is distorted in the diagonal plane (see the developed pattern of figure 2–9). To correct this, the P.S. (pattern symmetry) control may be adjusted to provide unequal proportions of the detector output to the two sweep voltages.

In figure 2–9, the P.S. control has been adjusted so that the modulating voltage to the vertical (K_V of figure 2–9) deflection modulator (V119 and V120) cuts off the modulators when at maximum, while the modulating voltage to the horizontal (K_H of figure 2–9) deflection modulators (V117 and V118) voltage

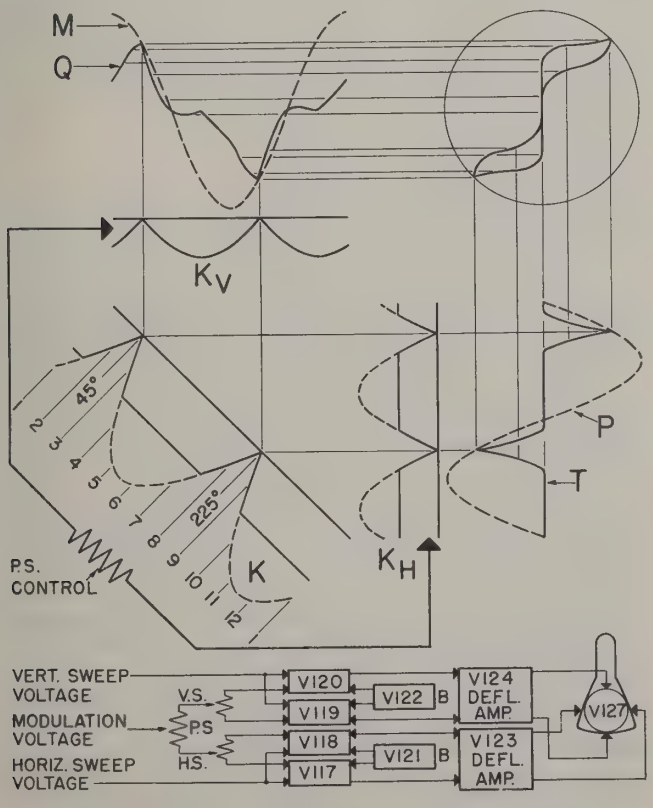


Figure 2–9. Radio Receiver R–256A/URD–2, P.S. Control

is at twice cut-off when at maximum. This changes the waveshapes of the vertical and horizontal deflection voltages so that the vertical deflection (Q of figure 2–9) is at a faster rate than the horizontal deflection (T of figure 2–9). Consequently the sides of the propeller pattern are expanded in the vertical plane.

Maladjustment of the P.S. control results in a propeller or calibration pattern having sides of unequal slope.

d. PH., V.G., AND H.G. CONTROLS.—Though the voltages from the alternator may be of equal amplitude and exactly 90° out-of-phase (Section 2, paragraph 2*a*), slight differences in the modulators, amplifiers, and deflection plates will cause the circular sweep pattern to be a distorted pattern. The H.G. and V.G. (gain) and the PH. (phase) controls correct this distortion by changing the phase and/or relative amplitudes of the sweep voltages at the input of the modulators as follows:

A study of P, M, and W of figure 2–13 will show that if the sweep voltages are of equal amplitudes and exactly 90° out-of-phase, the resultant pattern (W of figure 2–13) will be a perfect circle.

To compensate for phase distortion in the modulators and amplifiers, the phase relationship between the sweep voltages must be changed. This is accomplished by changing the value of PH. resistor R170 as follows: The phase shifter for the horizontal sweep voltage consists of R170 and C175, in series across the voltage source, E_G. In this voltage the amount of phase shift depends upon the ratio of the resistance (R170) to the capacitive reactance (C175). The current and voltage are in phase across R170, but the current leads the voltage across C175. When the resistance is large compared to the reactance, most of the opposition to current flow is caused by R170. The current through R170, then, follows the source current variations, and the voltage drop across R170 is the same as the source voltage. Thus there is no appreciable shifting of phase under this condition. When the resistance is small compared to the reactance, the greater part of the impedance to current flow is caused by the capacitive reactance of C175. This results in a condition where the current leads the voltage, and the phase of the output voltage accordingly lags that of the applied voltage. Therefore, the output voltage (EO of figure 2–12) may be shifted in phase by adjustment of the PH. control R170. A small value of R170 (clockwise rotation) results in the input and output voltages approaching in-phase relationship, and a large value of R170 (counterclockwise rotation), in out-of-phase relationship (see B of figure 2–12).

Because the values of R175 and C176 in the input

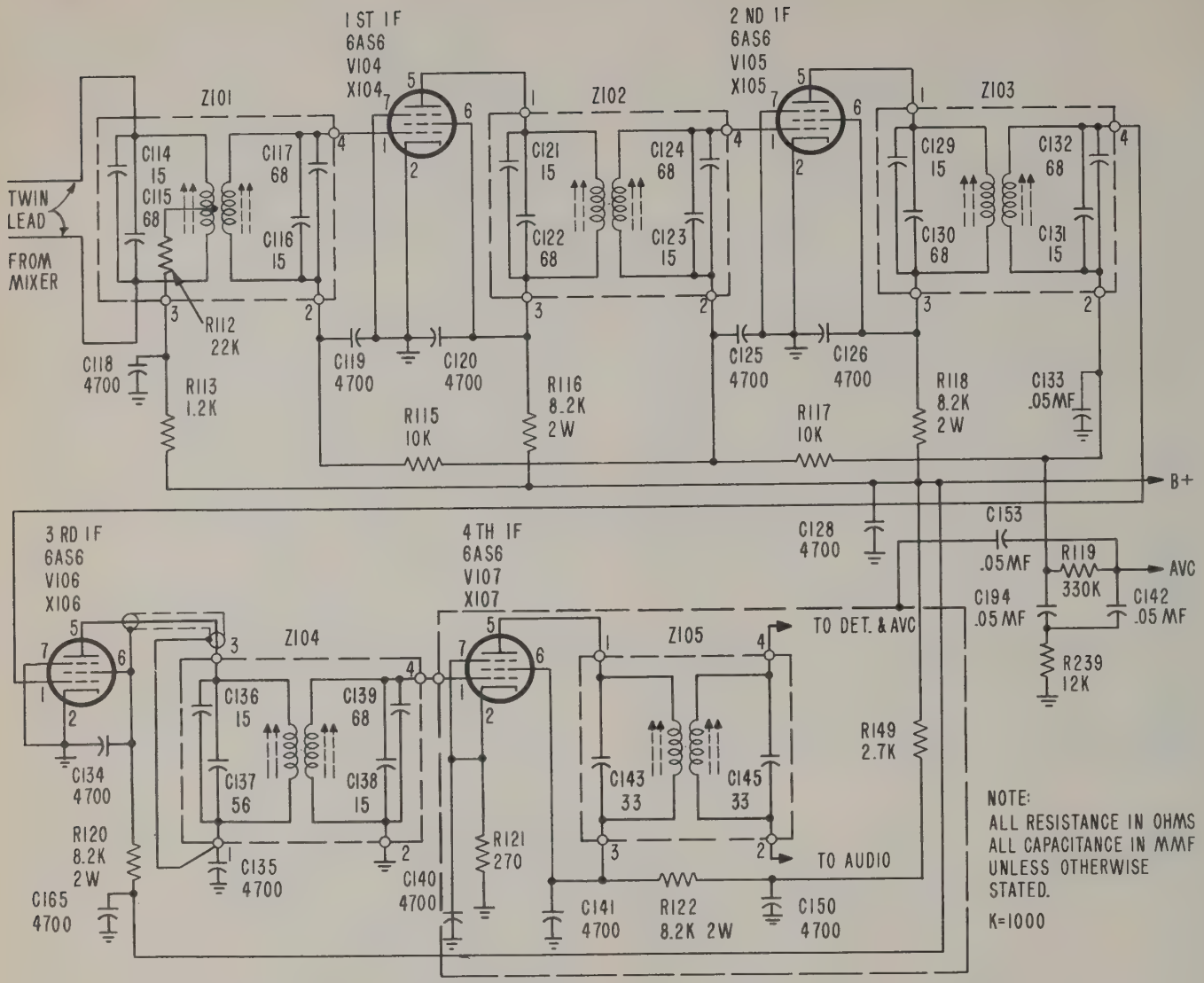


Figure 2–10. Radio Receiver R–256A/URD–2, I-F Circuit Schematic Diagram

of the *vertical* deflection voltage are fixed, the phase-shift in this circuit also is fixed. Because the value of R170 (of the phase-shift circuit R170 and C175) is variable, the phase-shift in the *horizontal* deflection voltage circuit also is variable (compare P and P_1 of figure 2–12). Therefore, varying the PH. control, R170, produces a phase-shift between the *horizontal* and *vertical* deflection voltages which is more or less than 90°. This is shown in figure 2–13. When the horizontal voltage (P of figure 2–13) is exactly 90° out-of-phase with the vertical voltage (M of figure 2–13), the circular pattern (W of figure 2–13) is a perfect circle. But when the phase-relationship is changed (by changing R170), the horizontal voltage (P_1 of figure 2–13) and the vertical voltage (M of figure 2–13) result in a pattern which is an ellipse having axes in the diagonal plane (W_{PH} of figure 2–13).

To compensate for any amplitude distortion, the amplitude of the horizontal and vertical inputs may be varied by varying the H.G. and V.G. controls R172 and R177. This is shown in figure 2–12. Increasing the amplitude of the horizontal voltage (P_2 of figure 2–13) by means of R172 results in the pattern becoming an ellipse (W_{HG} of figure 2–13).

Maladjustment of the PH. control results in the pattern being an ellipse in the diagonal plane (45°-225° or 315°-135°), and the cardinal points of the 36-lobe calibration pattern not being separated by 90°. Maladjustment of the H.G. or V.G. controls results in the circular pattern being an ellipse in the horizontal (90°-270°) plane or the vertical (0°-180°) plane and the 36 lobes of the calibration pattern not having the required 10° separation between the lobes.

e. H.D. AND V.D. CONTROLS.—The distortion (or balance) controls equalize the operating character-

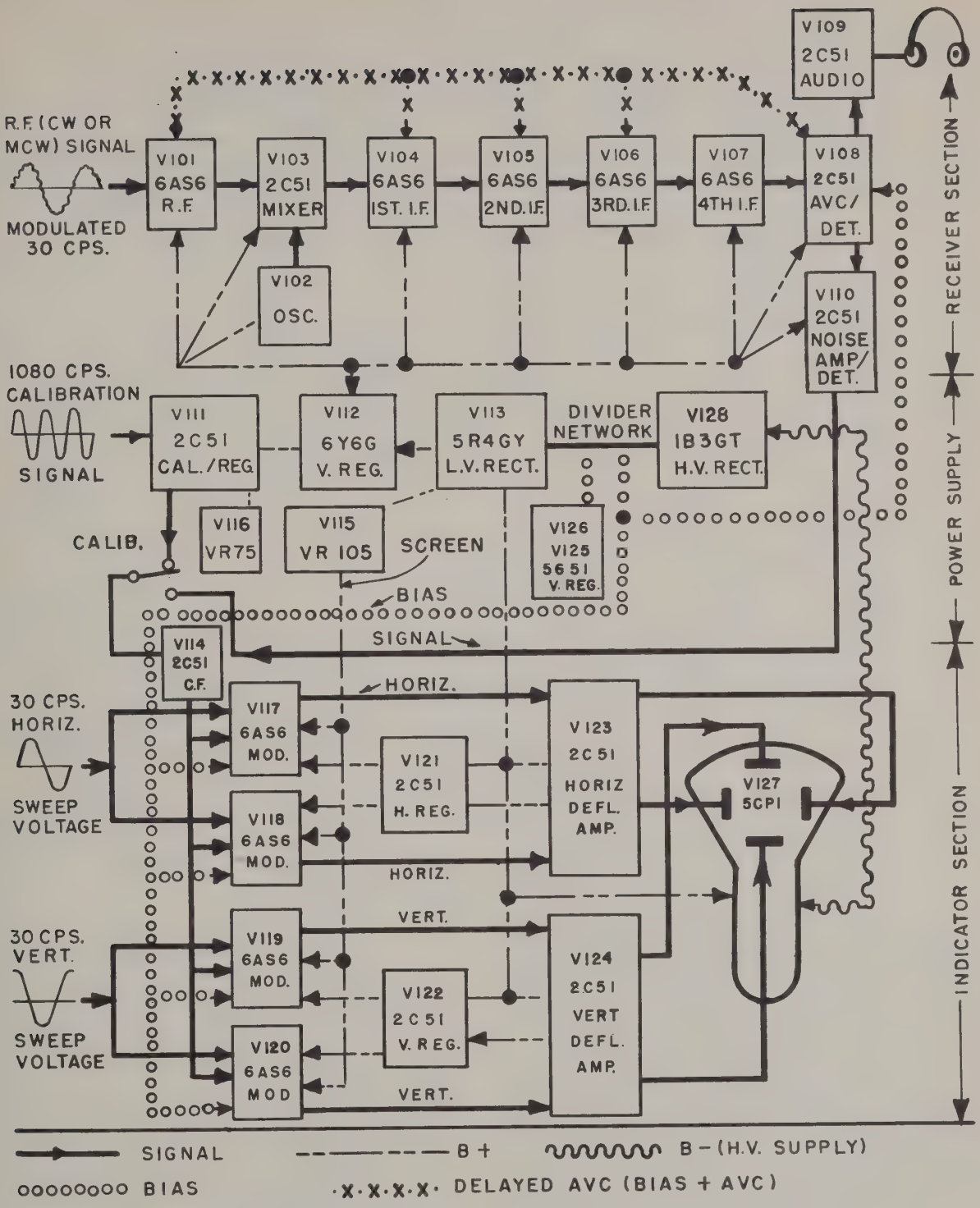


Figure 2–11. Radio Receiver R–256A/URD–2, Block Diagram

istics of the suppressors of the pairs of modulators so that the second harmonic content is cancelled. That is, if V119 is operating on the curved portion of the suppressor characteristic curve while V120 is operating on a more linear portion of the curve, the harmonic content of V119 is more than enough to cancel out that of V120, with the result that the combined output has a smaller negative amplitude and a greater positive amplitude. This results in the circular pattern protruding beyond the screen at 0° and failing to touch the edge of the screen at 180° (see figure 2–14).

If the V.D. control is adjusted so that the bias is changed to make both tubes operate on the same portion of the curve, the second harmonic content is

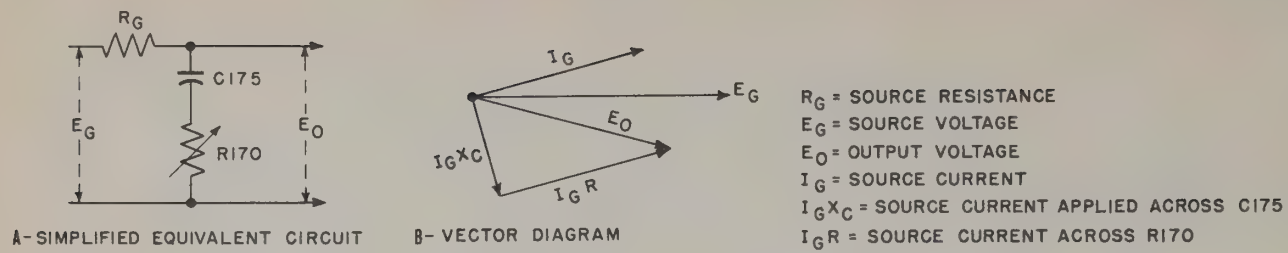


Figure 2–12. Radio Receiver R–256A/URD–2, Phase-Shift Network

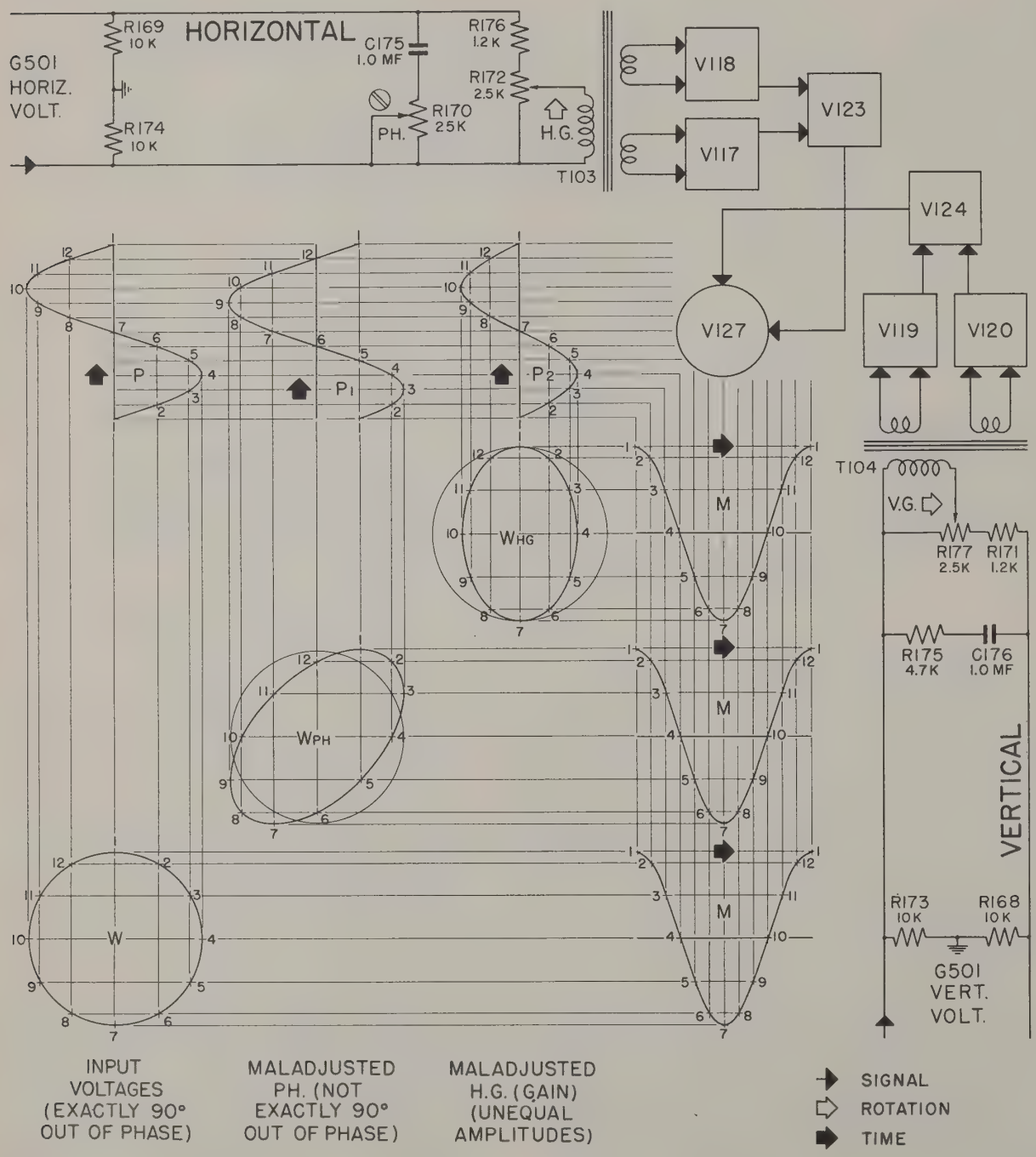


Figure 2–13. Radio Receiver R–256A/URD–2, PH. H.G., and V.G. Controls

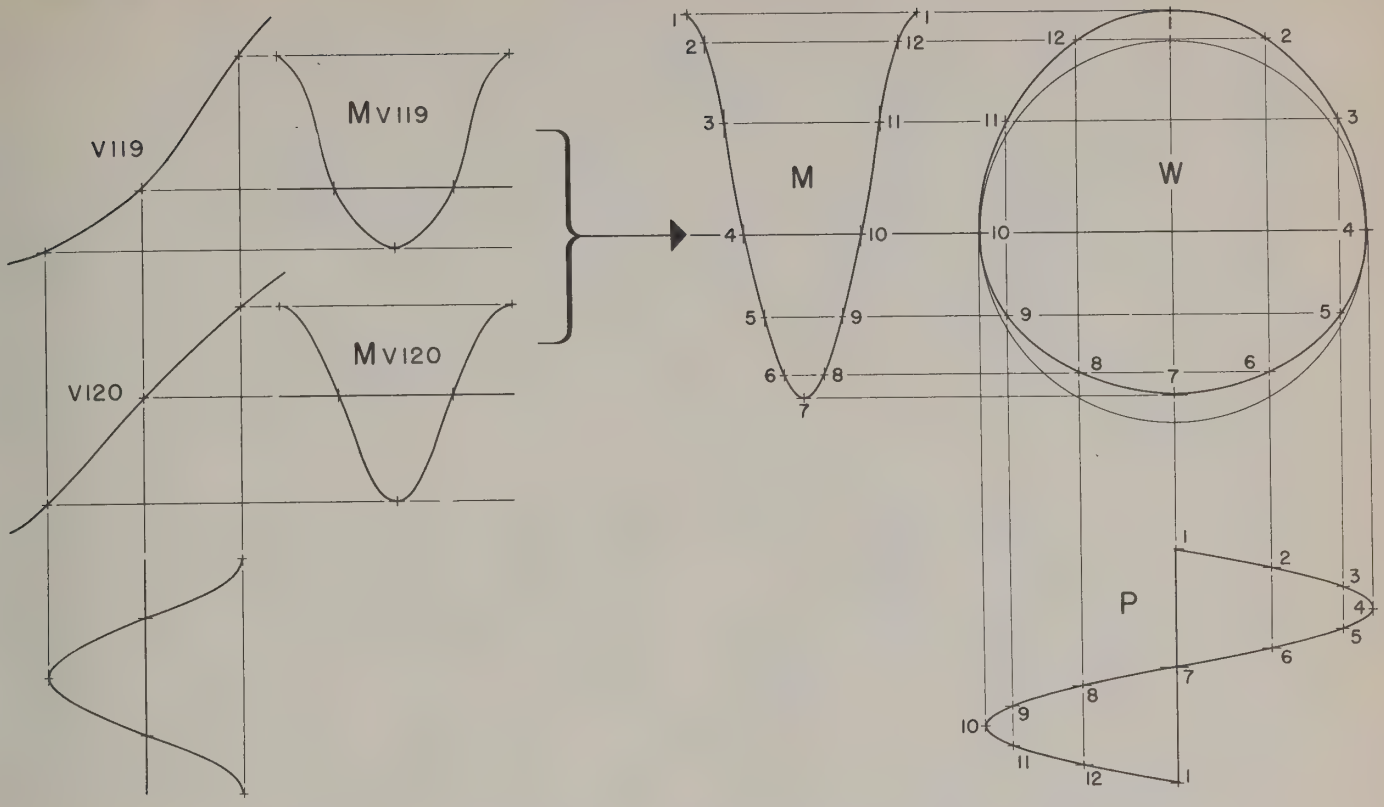
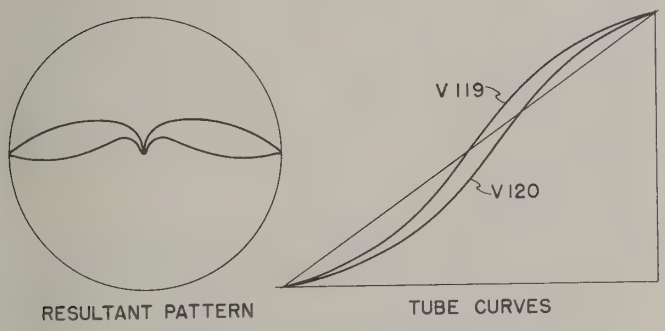


Figure 2–14. Radio Receiver R–256A/URD–2, H.D. and V.D. Controls



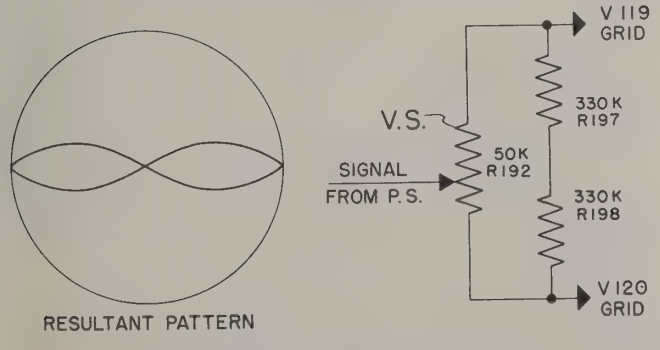


Figure 2–15. Radio Receiver R–256A/URD–2, V.S. and H.S. Controls

totally cancelled out and the circular pattern becomes a true circle.

Maladjustment of the H.D. or V.D. controls results in an imperfect circle which is flattened on one side and elongated on the opposite side.

f. V.S. AND H.S. CONTROLS.—The detector output is applied from the pattern symmetry control to the control grids of the four modulator tubes, and the sweep voltages are applied to the suppressor grids of these same tubes. Because of differences in tubes, one tube of a set (for instance V119) may modulate one of the sweep voltages to a greater extent than the other tube of the set (for instance V120), and the result is a pattern which is distorted in the plane controlled by these two tubes (see figure 2–15). To correct this, the V.S. (vertical symmetry) control may be adjusted to correct distortions in the vertical plane, and the H.S. (horizontal symmetry) control may be adjusted to correct distortions in the horizontal plane by providing unequal portions of the detector output to the various modulator tubes (see figure 2–16).

Maladjustment of V.S. and/or H.S. controls results in a propeller or calibration pattern having sides of unequal slopes.

g. HORIZ. AND VERT. CONTROLS.—The pattern-centering controls change the relative bias between two modulator tubes of a set—HORIZ. for

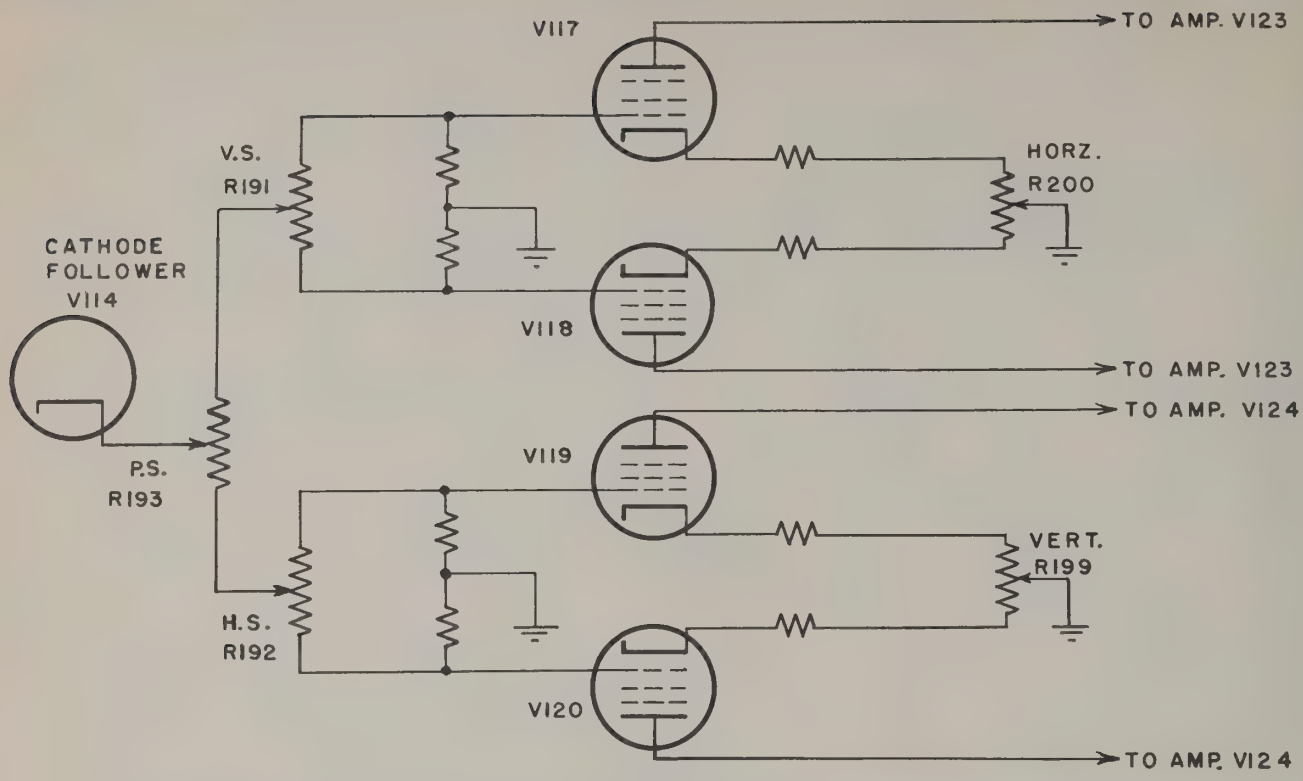


Figure 2–16. Radio Receiver R–256A/URD–2, Schematic of Modulators and Controls

V117 and V118, and VERT. for V119 and V120 so that the lobes of the pattern are of equal length and opposite lobes are 180° apart (see figure 2–15).

Maladjustment of the HORIZ. or VERT. controls results in a calibration pattern in which opposite cardinal point lobes are not separated by 180° and the lobes are not of equal length.

4. ANTENNA ASSEMBLY AS–410/URD–2.—A rotating-goniometer type of antenna system is used. None of the elements rotates, nor is there any external movement of any part of the assembly.

a. ELEMENTS.—The nine antenna elements comprise a four-pair cross-connected Adcock array with one sense element. Cross-connecting the pairs causes the antenna field response pattern to take a figure eight form, which ultimately is reproduced on the cathode-ray tube screen.

b. ROTATING GONIOMETER.—Rotating at 30 rps, the goniometer rotor takes voltage from each of the four pairs of elements 30 times per second. This voltage is capacitively coupled to the goniometer stator, which is connected to the receiver input through the transmission line. Also coupled to the stator is the sense coil from the sense antenna. When the sense relay is actuated this coil mixes sense voltage with the D/F voltage.

c. BAZOOKA (balance-to-unbalance transformer).—The output from the goniometer is balanced with respect to ground (both sides have same impedance to ground). To carry the r-f voltage to the receiver, a coaxial line is used which is unbalanced to ground. The bazooka is a device for making the two systems compatible. This is accomplished in the following manner:

At a distance of $\lambda/4$ from the goniometer end of the coaxial transmission line a shield is attached to the outer shield of the coaxial line. This shield (which is the rectangular waveguide on the side of the alternator-goniometer housing) raises the impedance of the coaxial cable outer shield above its former ground level. The end of the coaxial cable shield, then, is at very high impedance from ground, being a quarter-wave length from ground. One side of the balanced line is connected to this point. To create another point of high impedance identical with that of the coaxial cable braid, a quarter-wave rod is inserted in the waveguide and the other side of the balanced line connected to it. The center conductor of the transmission line is connected here.

5. TRANSMITTER T–207A/URD–2.

a. TRANSMITTER CHARACTERISTICS.

The target transmitter used in installation calibration of the receiver is a compact battery-operated unit. It may be mounted on tripod CBJO-10610 by engag-

ing the threaded socket on its base with the threads on the tripod. On its front panel are a meter, a tuning dial, and a selector switch. The telescoping antenna collapses into the top of the transmitter.

The transmitter covers the 97 to 170-mc range and comprises a single-tube r-f oscillator and audio oscillator-modulator. This is accomplished with a dual-triode type 3A5 tube. The base contains four batteries: —one 1.5-volt, and three 45-volt. Plate supply of 135 volts is taken from the three 45-volt batteries, which are connected in series.

Emission is either CW or MCW as selected by the pointer knob on the front panel.

b. CIRCUIT.

(1) OSCILLATOR.—To generate r-f signals in the specified frequency range, one-half of the 3A5 tube is used as a Colpitts oscillator. Interelectrode capacities of the tube furnish part of the feedback in the circuit necessary for sustained oscillations. Since the grid and plate of the tube are connected to opposite ends of the tank circuit, the required instantaneous polarity inversion on grid and plate is accomplished.

In the grid circuit of the oscillator section of the tube, a 0 to 200 microampere meter measures the amount of d-c grid current flowing, and so gives an indication of the strength of oscillations. (See figure 2–17 for schematic diagram.)

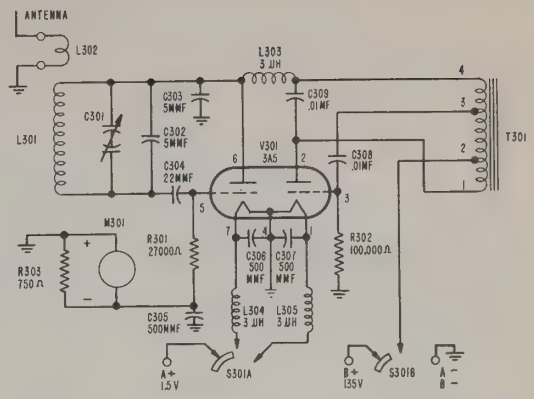


Figure 2–17. Target Transmitter, Schematic Diagram

(2) MODULATOR.—The second half of the type 3A5 tube is used as audio oscillator and modulator for the transmitter. The modulation transformer forms the series plate load of the r-f section. A 1000-cycle tone is generated by the audio oscillator, the frequency of which is determined by the capacitive reactance of C309 and the inductive reactance of T301.

SECTION 3
INSTALLATION AND INITIAL ADJUSTMENTS

1. UNPACKING EQUIPMENT.

Carefully unpack the equipment without jarring or dropping it. Handle the antenna assembly with special care because it is built to close tolerances. (See figure 3–1 for method of installation.)

2. LOCATION.

The most important consideration is the location of Antenna Assembly AS–410/URD–2. Mount the antenna assembly high enough to clear any obstruction in the immediate neighborhood. Since the antenna assembly is designed to receive signals from all directions in azimuth, it is essential that it be placed sufficiently high to clear immediate obstructions which might cause signal reflection and unequal pickup by the antenna assembly. The response of the antenna to signals below the horizontal plane is somewhat reduced; therefore, obstacles above the antenna assembly are more likely to cause trouble than are those below it. The antenna assembly must not be surrounded by trees or buildings which are taller than it is. An obstruction (such as a hill) which is higher than the antenna will cause errors in bearings. A desirable position for the antenna on shipboard is on a mast above and clear of interfering structures or objects. (See figure 3–3 for antenna assembly.)

Mount Radio Receiver R–256A/URD–2 at any location which is convenient to the operator and is within a 100-foot cable run of the antenna assembly. Remember that the antenna assembly is mounted on a 20-foot mast and only 80 feet of cable remains if the receiver is mounted on the same plane as the base of the mast. The r-f cable has a loss of approximately 2.5 db per 100 feet, so that an increase of cable length to 250 feet would result in about a 40 per cent decrease in receiver sensitivity. If possible, choose a location for the receiver where direct light will not fall on the face of the cathode-ray tube, although the green filter on the face of the tube reduces the effect of direct light. (See figure 3–4 for an outline drawing of the receiver.)

3. INSTALLATION.

The order in which the steps of the installation procedures are performed is unimportant as long as each step is complete in itself. For example, the antenna may be assembled on the mast (step *c.*) either before or after the mast is erected (step *e.*) depending upon the available installation equipment (if any) and the number of personnel.

a. COMPASS AND TRANSMITTER LOCATION. —To provide that the bearings are relative to the correct reference point, it is important that the transmitter be located so that azimuth 0° is aligned with either North or the bow of the ship. If possible the transmitter should be on the North end (in shore installations) or on the bow end of a fore-to-aft line (in ship installations) with the antenna at the South end or somewhere on this fore-and-aft reference line. However, should it not be practical to set up the transmitter North of the antenna assembly, calibration could be made by setting up the transmitter East or starboard and adjusting for a 90° reading, or South or astern for a 180° reading, or West or port for a 270° reading. The magnetic compass is used for locating the antenna assembly and transmitter on this 0° (or 90°, 180°, or 270°) reference line. The procedure for locating the transmitter is as follows:

(1) Mount Magnetic Compass CAZA–10666 on Tripod CBJO–10610 (see figures 3–5 and 3–6), and locate the assembly approximately North (or at the bow) about 20 feet from the mast and antenna site and as high as possible.

(2) Level the compass and loosen the needle. In shore installations, and if true north bearings are desired, consult a map of the area for the magnetic variation and move the scale of the compass to correct for the magnetic variation. (See figure 3–7.)

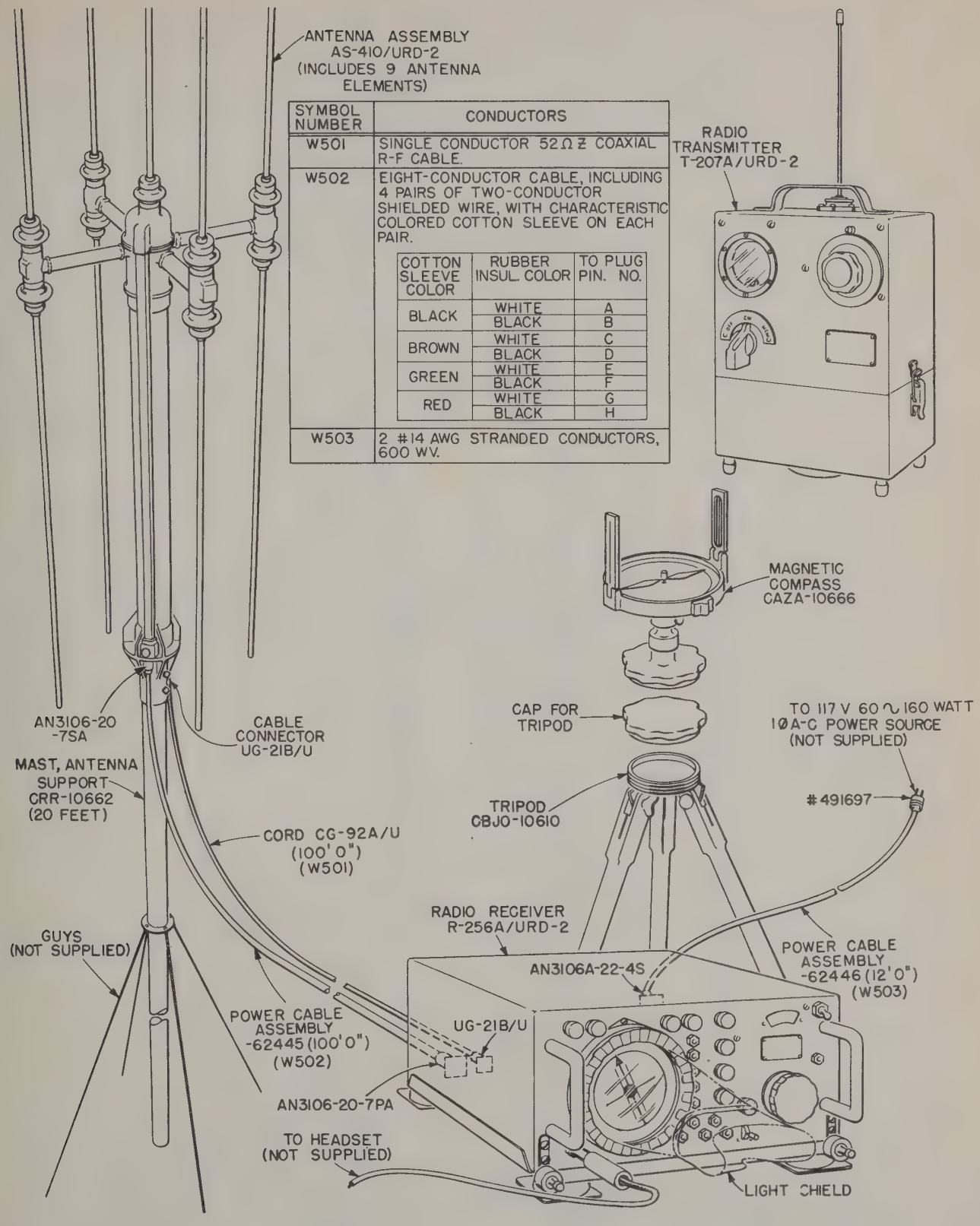
(3) Lift up the sights and loosen the knurled nut which locks the upper part of the compass to the spindle. (See figure 3–8.) Sight through the compass at the antenna, and note if the compass needle is on 180° (or whatever reference line was chosen).

(4) If the compass and base of the mast are not exactly on the same reference line, continue moving the tripod, leveling the compass, and sighting at the mast or antenna until the compass is in the correct position. If the mast and antenna have previously been erected and assembled, the arrow on top of the antenna assembly should be pointed toward North or the bow of the ship. Lock the compass.

b. ASSEMBLY OF ANTENNA. — Assemble Antenna Assembly AS–410/URD–2 as follows:

CAUTION

BE SURE THAT NO ANTENNA FEED-THROUGH INSULATORS OTHER THAN PART NUMBER E426 ARE INSTALLED.



SYMBOL NUMBER	CONDUCTORS
W501	SINGLE CONDUCTOR 52 Ω Z COAXIAL R-F CABLE.
W502	EIGHT-CONDUCTOR CABLE, INCLUDING 4 PAIRS OF TWO-CONDUCTOR SHIELDED WIRE, WITH CHARACTERISTIC COLORED COTTON SLEEVE ON EACH PAIR.
W503	2 #14 AWG STRANDED CONDUCTORS, 600 WV.

COTTON SLEEVE COLOR	RUBBER INSUL. COLOR	TO PLUG PIN. NO.
BLACK	WHITE	A
	BLACK	B
BROWN	WHITE	C
	BLACK	D
GREEN	WHITE	E
	BLACK	F
RED	WHITE	G
	BLACK	H

Figure 3–1. Installation of Radio Direction Finder Set AN/URD–2A

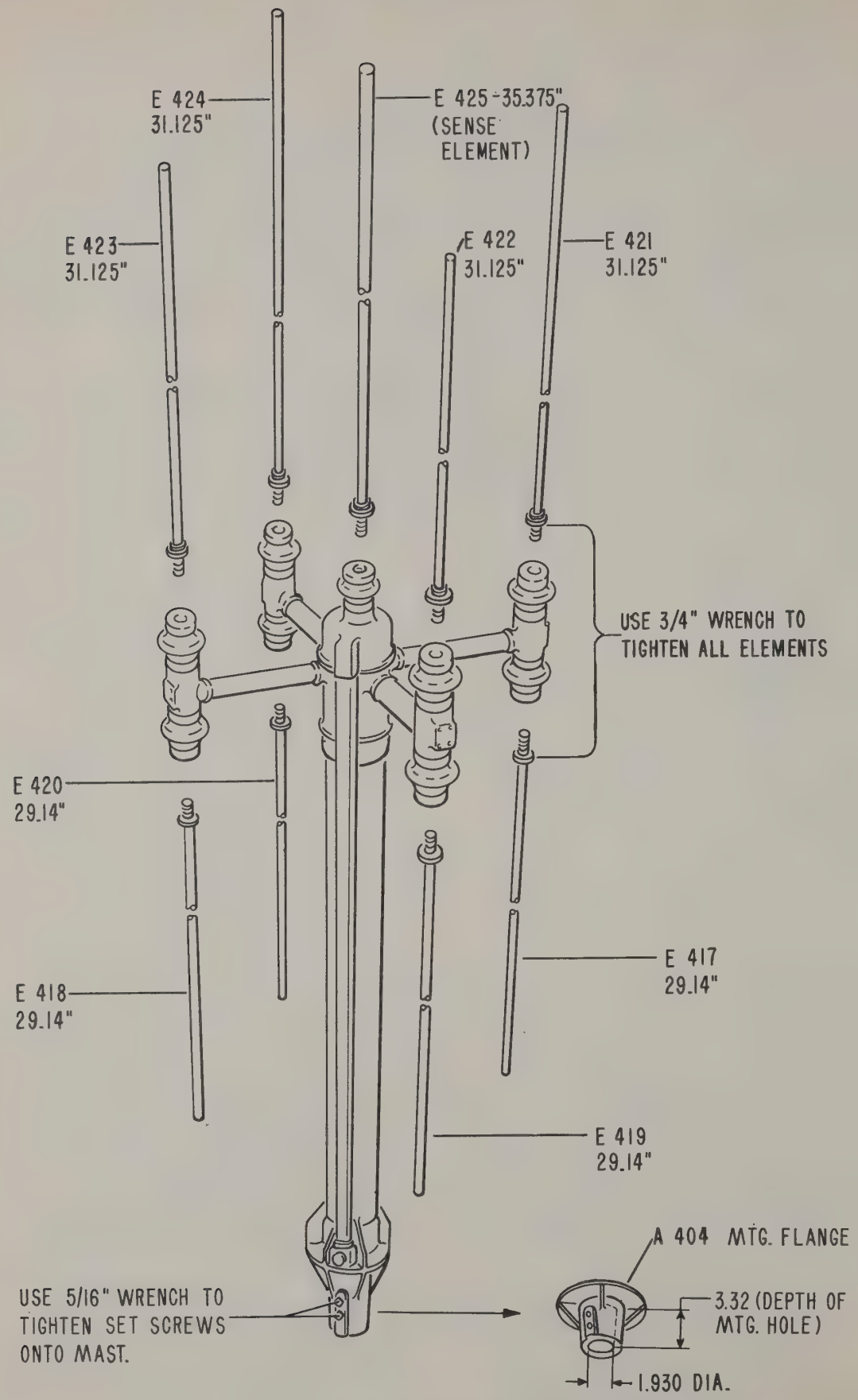
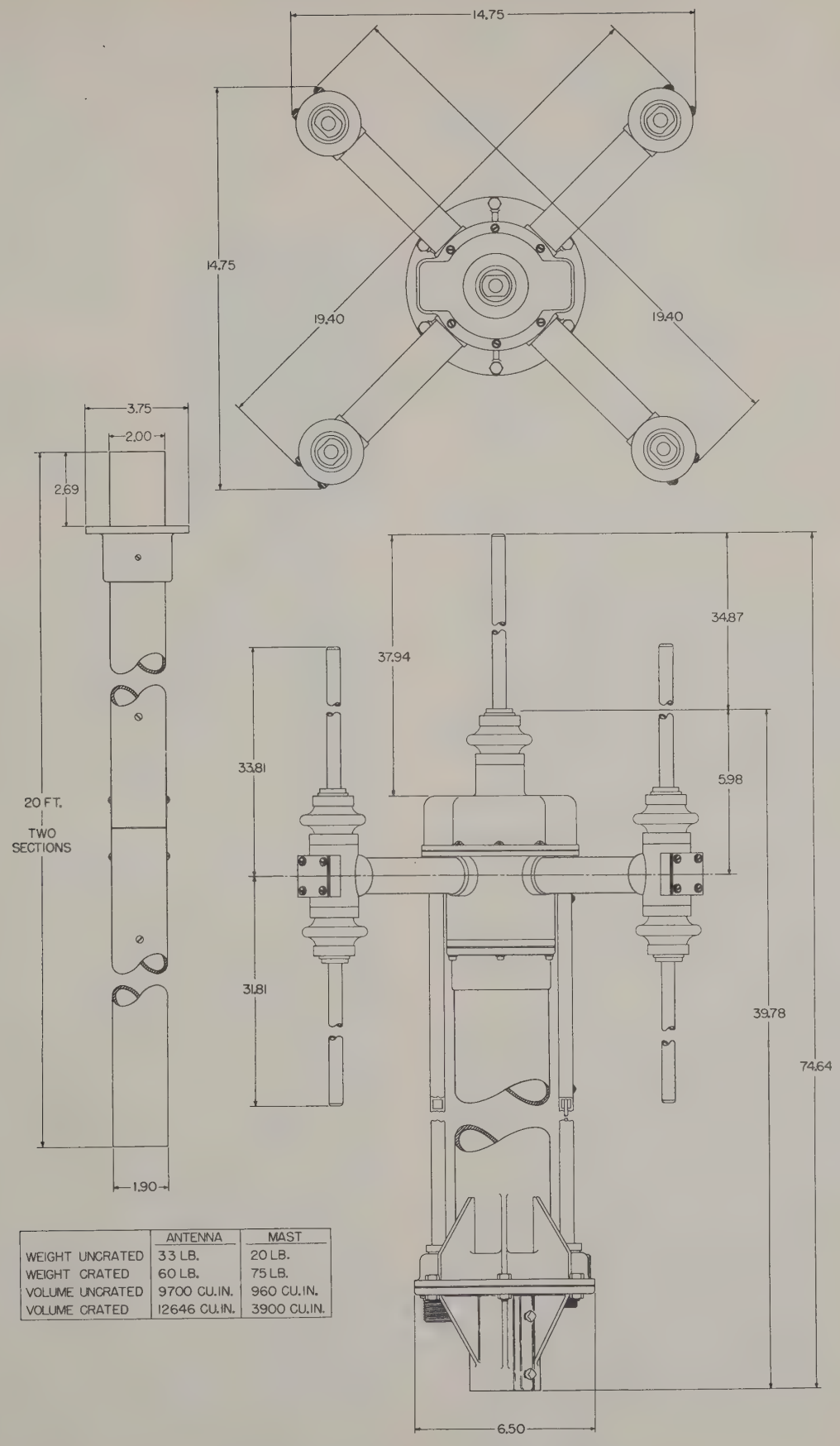
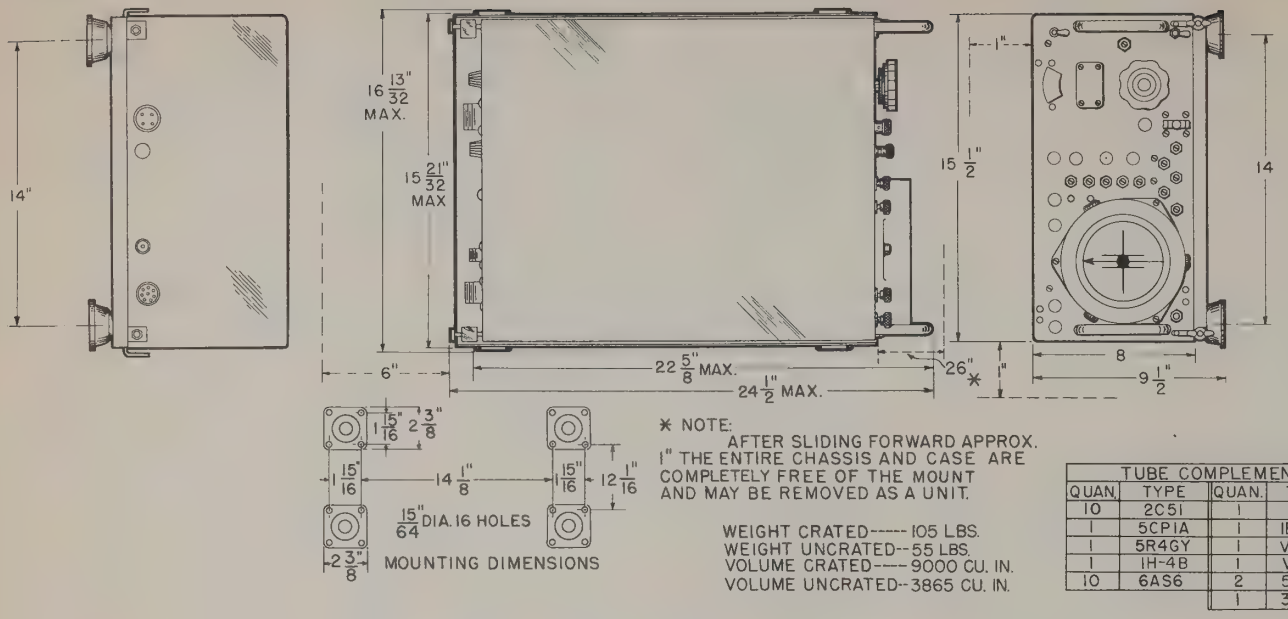


Figure 3–2. Assembly of Antenna AS–410/URD–2



	ANTENNA	MAST
WEIGHT UNCRATED	33 LB.	20 LB.
WEIGHT CRATED	60 LB.	75 LB.
VOLUME UNCRATED	9700 CU.IN.	960 CU.IN.
VOLUME CRATED	12646 CU.IN.	3900 CU.IN.

Figure 3–3. Antenna and Mast Outline



TUBE COMPLEMENT			
QUAN.	TYPE	QUAN.	TYPE
10	2C51	1	6Y6G
1	5CP1A	1	1B3GT
1	5R4GY	1	VR-75
1	1H-4B	1	VR-105
10	6AS6	2	5651
		1	3A5

Figure 3–4. Radio Receiver R–256A/URD–2, Outline Drawing

(1) Assemble the eight antenna elements (figure 3–2) and the one sense antenna element (longest element) to the antenna assembly. Positions of all elements are shown in figure 3–2. The four shortest elements are screwed into the *bottom* of the brackets.

(2) Connect the antenna r-f cable (5 of figure 3–6) to the proper receptacle on the bottom flange of the antenna assembly (6 of figure 3–6).

(3) Connect the goniometer power cable (4 of figure 3–6) to the remaining receptacle on the bottom flange of the antenna assembly.

c. ASSEMBLY OF ANTENNA TO MAST.—Loosen the two set screws (8 of figure 3–6) on the antenna, place the antenna assembly on the end of the mast having the flange (7 of figure 3–6), and tighten the two set screws.

d. SHORE INSTALLATION OF MAST AND ANTENNA ASSEMBLY.—A typical mast and antenna shore installation is shown in figure 3–21. While considerable variation in detail will be found between different installations, all will follow the same general pattern.

(1) The following materials, not supplied, are required:

(a) Guy anchors. Type determined by local considerations.

(b) Mast mounting pedestal.

(c) Guys. Navy stock 22–R–194 1/4 inch phosphor bronze, or 22–C–2020 3/16 inch galvanized steel. Other cable of similar size or strength may also be used.

(d) Cable clamps and other miscellaneous guy hardware.

(2) Before raising mast and antenna, assemble as per paragraph 3*b* and 3*c* taking care before raising mast to mark the mast to indicate the direction of the north orienting arrow (see figure 3–6). Secure guys to the guy plate of the mast, install anchors, anchor rods, and mast mounting pedestal. Place base of mast at mast mounting pedestal and extend guys from mast. Raise mast by lifting antenna assembly (caution: do not let the mast base slip) and pulling the two far guys.

Since the mast is aluminum, when the antenna assembly gets beyond reach, continue lifting by means of a pike pole or similar device until the mast is less than 30° from vertical. *Do not* attempt to complete raising of mast (after antenna is beyond reach) by pushing on mast. After mast is erect, orient so arrow on antenna assembly points due north, secure mast to mounting pedestal, plumb mast, adjust and secure guys.

e. SHIPBOARD INSTALLATION OF ANTENNA ASSEMBLY.—The antenna assembly should be mast mounted and clear of interfering structures or objects. The mounting provisions on the ship's mast must fit the opening at the bottom of the antenna assembly, that is, similar to the top of the mast section shown in figure 3–2. It is necessary that the antenna, when mounted on the ship's mast be positioned such that the north orienting arrow (1 of figure 3–6) is pointed toward the bow of the ship and aligned fore and aft.

f. INSTALLATION OF RECEIVER.—Install Radio Receiver R–256A/URD–2 where it will be convenient to the operator and where it will be within the proper

Figure 3–5. Radio Transmitter T–207A/URD–2, Including Tripod and Compass

cable run. The installation procedure is as follows:

(1) If the receiver is on the shockmount, loosen the two thumbscrews on the front of the shockmount, free them from the catches on the receiver, and slide the receiver forward out of the shockmount.

(2) Mount the shockmount in a position which will permit the cables to be connected, and the receiver to be removed, if necessary. (See figure 3–4.)

(3) Complete the grounds from the four ground straps to the surface on which the shockmount rests, if such surface is metal.

(4) Slide the receiver into the shockmount and secure it by means of the two thumbscrews on the front of the shockmount

(5) Connect the goniometer power cable (4 of figure 3–6), the antenna r-f cable (5 of figure 3–6), and the input power cable (13 of figure 3–6 to the proper receptacles on the rear of the receiver. The connections will be obvious because of the sizes of receptacles.

(6) Connect the remaining end of the power input cable (13 of figure 3–6) to a 117-volt, 60-cycle, single-phase, a-c source.

(7) Install the sunshade on the operating ring of the receiver.

4. TARGET TRANSMITTER T–207A/URD–2.

a. TURNING TRANSMITTER OFF. — Prior to opening the transmitter case and whenever the transmitter is not in use, the OFF-CW-MCW function switch (1 of figure 3–10), should be at OFF.

b. OPENING TRANSMITTER CASE.—Loosen the two suitcase-type snap fasteners located on the lower half of the transmitter case (2 of figure 3–10) and separate the two halves of the transmitter by pulling up. Note if the four batteries (3 and 4 of figure 3–10) have been installed in the transmitter and if the plugs on the cable are in the receptacles of the batteries. If batteries are not installed and connected, install and connect them as described in the following step.

c. INSTALLATION OF BATTERIES.—Install and connect the three JAN–BA–63 and the JAN–BA–65 batteries as follows:

(1) Loosen the screws and remove the battery hold-down spring (5 of figure 3–10).

(2) Place the four batteries in the four compartments of the lower half of the transmitter case. Install the four batteries with the receptacles up.

(3) Replace the battery hold-down spring assembly (5 of figure 3–10), and secure.

(4) Place the plugs of the cable and plug assembly (6 of figure 3–10) in the proper receptacles of the batteries. Placement of the plugs will be obvious.

(5) Assemble the two halves of the transmitter and secure by means of the two fasteners (2 of figure 3–10).

d. MOUNTING OF TRANSMITTER.—The transmitter is provided with a 3″-12 threaded cap for mounting on the tripod, and four rubber feet for use on a bench (see figure 3–5).

5. PRE-OPERATIONAL CHECK.

After the equipment is installed (Section 3, paragraph 3) and prior to calibration (Section 3, paragraph 6), check operation as follows:

a. TURNING EQUIPMENT ON.—Turn on Radio Receiver R–256A/URD–2 by placing the POWER ON-OFF switch (12 of figure 3–11) in the ON position.

b. CHECKING FOR PATTERNS.—Prior to calibration, it is necessary only that patterns be obtained on the cathode-ray tube screen. It is not necessary that these patterns be perfect. To check for the existence of patterns, proceed as follows:

(1) Place the MOTOR ON-OFF switch (10 of fig-

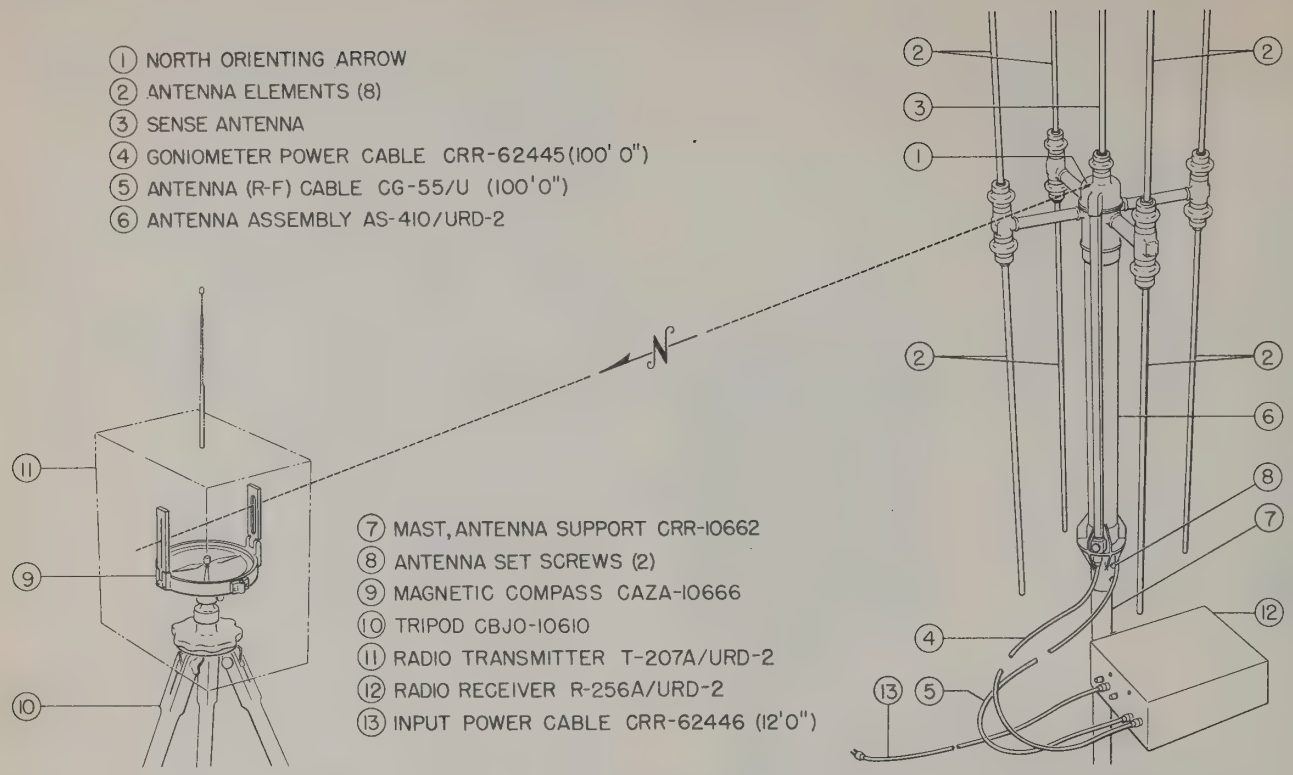

① NORTH ORIENTING ARROW
② ANTENNA ELEMENTS (8)
③ SENSE ANTENNA
④ GONIOMETER POWER CABLE CRR-62445(100' 0")
⑤ ANTENNA (R-F) CABLE CG-55/U (100'0")
⑥ ANTENNA ASSEMBLY AS-410/URD-2
⑦ MAST, ANTENNA SUPPORT CRR-10662
⑧ ANTENNA SET SCREWS (2)
⑨ MAGNETIC COMPASS CAZA-10666
⑩ TRIPOD CBJO-10610
⑪ RADIO TRANSMITTER T-207A/URD-2
⑫ RADIO RECEIVER R-256A/URD-2
⑬ INPUT POWER CABLE CRR-62446 (12'0")
N

Figure 3–6. Orientation of Antenna

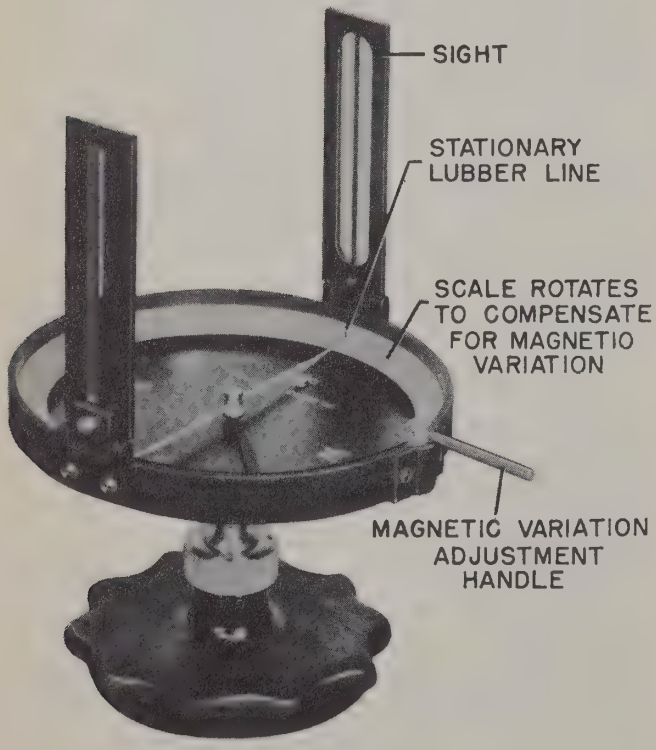


Figure 3–7. Magnetic Compass CAZA 10666, Top view

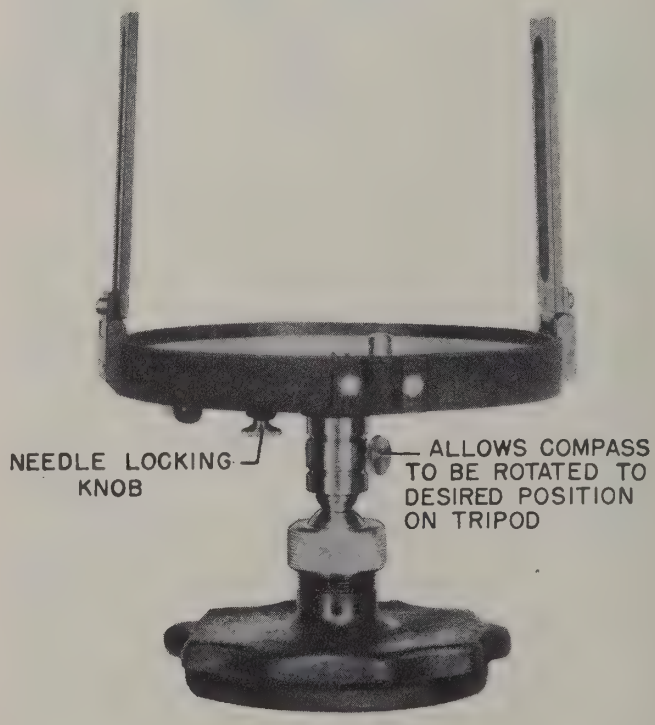
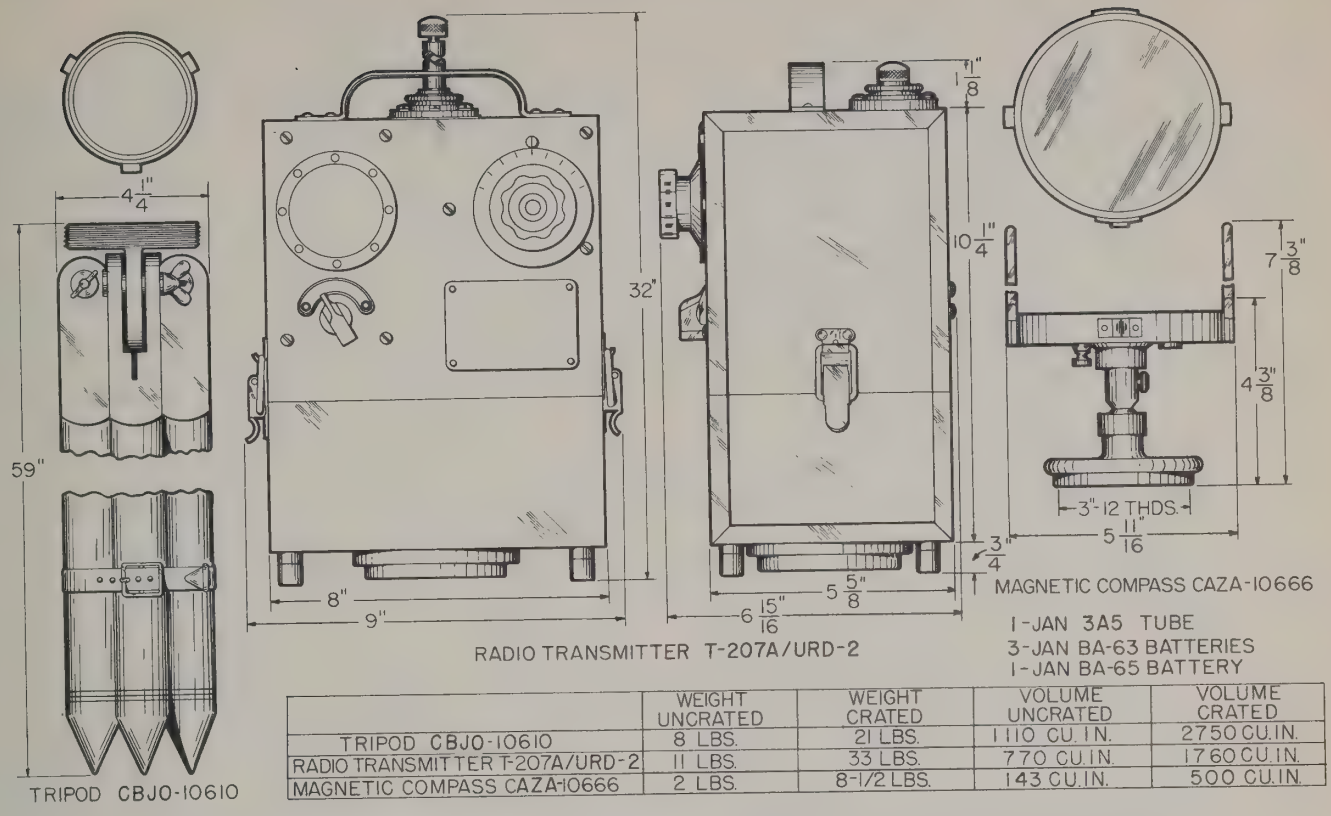


Figure 3–8. Magnetic Compass CAZA 10666, Side View

ure 3–11) in the ON position, the R.F. SENS. control (6 of figure 3–11) in the fully counterclockwise position, and press in and rotate the BRILLIANCY (3 of figure 3–11) FOCUS (2 of figure 3–11), and CIRCLE DIA. (8 of figure 3–11) controls until a circular pattern appears on the screen. DO NOT PLACE THE



	WEIGHT UNCRATED	WEIGHT CRATED	VOLUME UNCRATED	VOLUME CRATED
TRIPOD CBJO-10610	8 LBS.	21 LBS.	1110 CU. IN.	2750 CU.IN.
RADIO TRANSMITTER T-207A/URD-2	11 LBS.	33 LBS.	770 CU.IN.	1760 CU.IN.
MAGNETIC COMPASS CAZA-10666	2 LBS.	8-1/2 LBS.	143 CU.IN.	500 CU.IN.

Figure 3–9. Magnetic Compass CAZA 10666, Radio Transmitter T–207/URD–2, and Tripod CBJO–10610, Outline Drawing

"BRILLIANCY" CONTROL IN THE MAXIMUM (FULLY CLOCKWISE) POSITION. The circular pattern probably will not be a perfect circle (at this time). If a propeller-shape pattern is obtained, the tuning dial (11 of figure 3–11) should be rotated until no signal is received.

(2) Place the CALIBRATE-SENSE switch (14 of figure 3–11) in the CALIBRATE position (it will remain in this position), and adjust the BRILLIANCY (3 of figure 3–11), and FOCUS (2 of figure 3–11) controls for a clear, sharp pattern. DO NOT PLACE THE "BRILLIANCY" CONTROL IN THE MAXIMUM (FULLY CLOCKWISE) POSITION. The pattern should be a 36-lobe pattern resembling a daisy. It will (at this time) be distorted.

(3) Place the CALIBRATE-SENSE switch (14 of figure 3–11) in the center (off) position (circular pattern reappears), and adjust the tuning dial (11 of figure 3–11) until the circular pattern is replaced by a propeller blade (or a pattern which *contains* a shape resembling a propeller blade). It may be necessary to adjust the R.F. SENS. control.

(4) Hold the CALIBRATE-SENSE switch (14 of figure 3–11) in the SENSE position, and note if the pattern changes shape (see figure 3–19 for some possible sense patterns).

c. CHECKING LIGHTS.—Adjust the LIGHTS control (5 of figure 3–11), and note if the azimuth scale (16 of figure 3–11) and MEGACYCLES dial (9 of figure 3–11) are illuminated.

d. CHECKING AUDIO.—Plug phones in the jack (19 of figure 3–11), turn the AUDIO GAIN (7 of figure 3–11) clockwise, and adjust the tuning dial (11 of figure 3–11) for a signal.

e. TURNING EQUIPMENT OFF.—To turn off the equipment, place the POWER ON-OFF switch (12 of figure 3–11) in the OFF position.

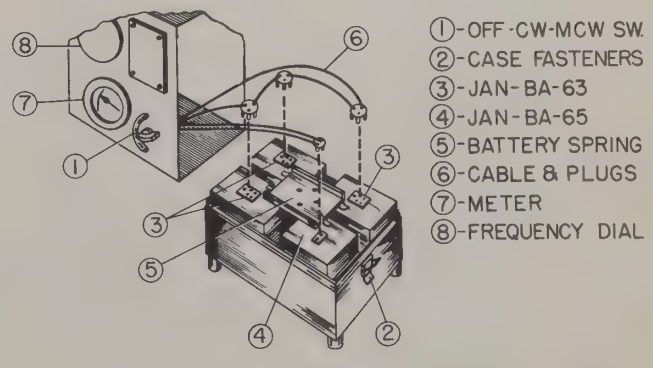
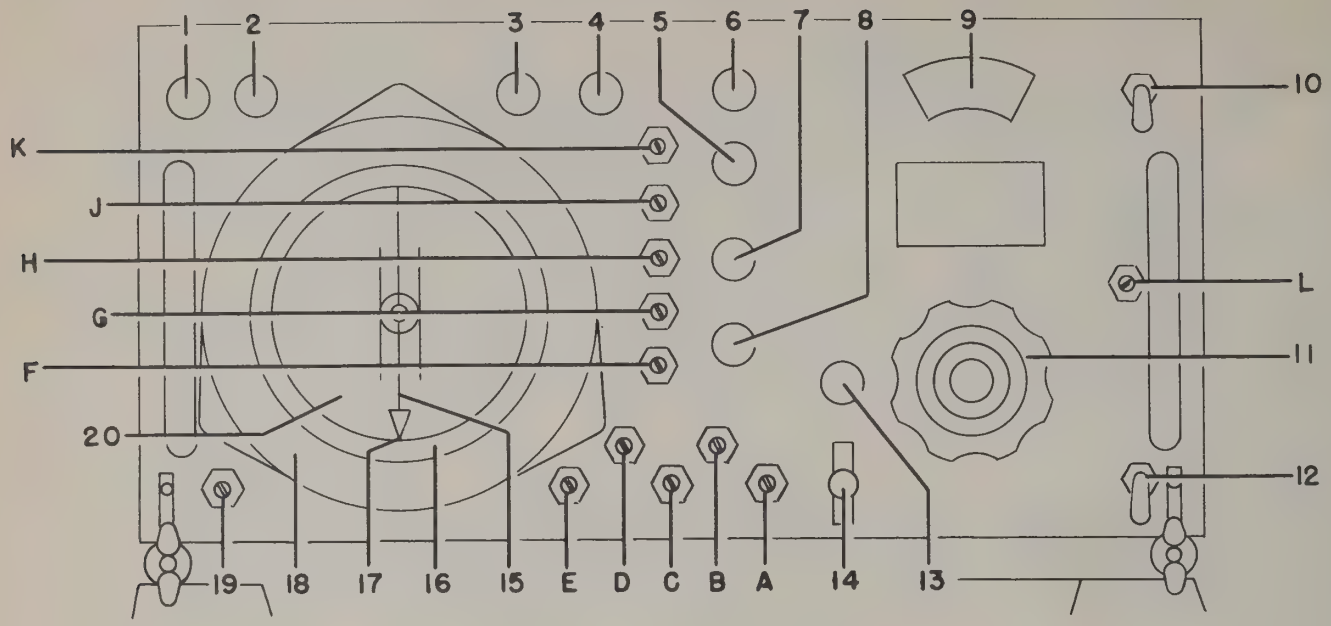


Figure 3–10. Installation of Transmitter Batteries



NO.	NAME OF CONTROL	TYPE	FUNCTION AND REMARKS
1	VERTical	Oper-calib.	Press-to-rotate. Moves pattern for 10° separation.
2	FOCUS	Operation	Press-to-rotate. Adjust for sharp pattern.
3	BRILLIANCY	Operation	Press-to-rotate. Adjust for bright pattern.
4	HORIZontal	Oper-calib.	Press-to-rotate. Moves pattern for 10° separation.
5	LIGHTS	Operation	Illumination of 9 and 16.
6	R.F. SENSitivity	Operation	Shapes D/F propeller pattern. Radio freq. gain.
7	AUDIO GAIN	Operation	Audio volume control.
8	CIRCLE DIAmeter	Both	Press-to-rotate. Adjust to make pattern touch 16.
9	MEGACYCLES	Operation	Indicates operating frequency. Rotated by 11.
10	MOTOR ON-OFF	Operation	"OFF" for audio reception. (Simultaneous at "ON")
		Both	"ON" for patterns. (17 controls type of pattern.)
11	Tuning dial	Operation	Selects equipment operating frequency. Moves 9.
12	POWER ON-OFF	Both	Turns complete AN/URD–2A equipment ON or OFF.
13	LOCK	Operation	Locks 11 to prevent accidental adjustment.
14	CALIBRATE-SENSE	Calibration	"CALIBRATE" for 36-lobe calibration pattern.
		Operation	Center for D/F propeller-shaped pattern
		Operation	"SENSE" for indication of true-bearing direction.
15	Cursor	Both	For bisecting or aligning patterns.
16	Azimuth scale	Operation	Indicates bearing when pattern is symmetrical to 15.
17	Arrow	Operation	Points to bearing on 16.
18	Operating ring	Operation	Rotates 15 and 17 for aid in obtaining bearings.
19	PHONES	Operation	Headset jack for audio reception.
20	Screen	Operation	Carries 15 and 17 and neutralizes effect of light.
A	V.G. (vert. gain)	Calibration	Screwdriver adjustment. Vertically expands pattern.
B	H.D. (distortion)	Calibration	Screwdriver adjustment. Corrects horizontal distortion.
C	PH. (phase)	Calibration	Screwdriver adjustment. Phase correction (90° sep.)
D	V.D. (distortion)	Calibration	Screwdriver adjustment. Corrects vertical distortion.
E	H.G. (hor. gain)	Calibration	Screwdriver adjustment. Horiz. expands pattern.
F	H.S. (symmetry)	Calibration	Screwdriver adjustment. Horizontal symmetry.
G	H.C. (center)	Calibration	Screwdriver adjustment. Horiz. centering of spot.
H	P.S. (pat. sym.)	Calibration	Screwdriver adjustment. Symmetry of pattern.
J	V.C. (center)	Calibration	Screwdriver adjustment. Vert. centering of spot.
K	V.S. (symmetry)	Calibration	Screwdriver adjustment. Vertical symmetry.
L	CAL.	Calibration	Screwdriver adjustment. Calibration pattern diameter.

Figure 3–11. Radio Receiver R–256A/URD–2, Front Panel Controls.

6. INITIAL CALIBRATION PROCEDURE.

The first time the equipment is calibrated, and whenever the calibration controls are very far out of adjustment, the following calibration procedure should be used.

a. CONTROLS.—There are three types of controls; the normal type controls, which are frequently used during operation; the press-to-rotate knobs which are occasionally used but which would cause bearing inaccuracies if accidentally adjusted; and screwdriver controls which are infrequently used. These controls and their functions are shown in figure 3–11 and are described in the following lists:

(1) OPERATIONAL CONTROLS. — These are normal type controls for operational adjustments. The effect of adjustment of these will be obvious, and the adjustments may be made at any time. The nomenclature and functions are as follows:

POWER ON-OFF (12 of figure 3–11)—Turns equipment on or off.

MOTOR ON-OFF (10 of figure 3–11)—Selects the type of pattern and the function of the equipment; OFF for audio reception of signals, and ON for direction-finding and circle calibration patterns.

LIGHTS (5 of figure 3–11) — Controls the amount of illumination on the azimuth scale and MEGACYCLES dial.

Tuning dial (11 of figure 3–11)—Selects the operating frequency. Rotates the tuning capacitors and the MEGACYCLES dial.

LOCK (13 of figure 3–11)—Locks the tuning dial to prevent accidental adjustment.

R.F. SENS. (6 of figure 3–11)—Varies the r-f sensitivity and consequently the propeller blade direction-finding pattern.

Operating ring (18 of figure 3–11)—Aids in obtaining accurate bearings. Moves the cursor-carrying green filter screen.

Azimuth scale (16 of figure 3–11)—Indicates bearing to signal source. Calibrated in 2° intervals.

Cursor (15 of figure 3–11)—Aids in obtaining accurate direction-finding bearings. Consists of three parallel lines, an arrow, and a perpendicular line etched on the screen.

CALIBRATE-SENSE (14 of figure 3–11) — Selects type of pattern (when MOTOR ON-OFF switch is in the ON position); CALIBRATE for 36-lobe calibration pattern (locking position), center (off) for propeller-blade direction-finding pattern, and SENSE for indication of direction pattern (non-locking position).

PHONES (19 of figure 3–11)—Headset jack for audio reception of signals.

AUDIO GAIN (7 of figure 3–11)—Volume control for audio reception.

(2) PRESS-TO-ROTATE CONTROLS. — These five knobs must be pressed to engage the controls which they operate. This safety factor is provided to prevent accidental adjustment of these controls. Under normal conditions, these five controls may be adjusted to correct the calibration pattern and to provide good direction-finding patterns. Periodically the calibration pattern should be checked to ascertain that the 36 lobes are 10° apart, and the VERT. and HORIZ. controls pressed in and rotated to correct this pattern. When the correct calibration pattern can not be obtained by adjustment of these controls, the screwdriver adjustments are performed as described in steps *b.* to *g.* (Section 3, paragraph 6*b.* to 6*g.* inclusive). The press-to-rotate controls and their functions are as follows:

CIRCLE DIA. (8 of figure 3–11)—Controls the diameter of patterns to provide that the tips of the patterns touch the azimuth scale.

HORIZ. (4 of figure 3–11)—Moves the pattern horizontally across the screen.

VERT. (1 of figure 3–11)—Moves the pattern vertically on the screen.

BRILLIANCY (3 of figure 3–11)—Controls the brightness of the patterns. This control should never be left in the fully clockwise (maximum) position.

FOCUS (2 of figure 3–11)—Controls the sharpness of the pattern.

(3) SCREWDRIVER ADJUSTMENTS. — These screwdriver controls should be adjusted in accordance with the procedure of steps *b.* to *g.* inclusive. The screwdriver adjustments are as follows:

H.C. (G of figure 3–11)—Horizontal centering of pattern spot (center).

V.C. (J of figure 3–11)—Vertical centering of pattern spot (center).

H.G. (E of figure 3–11)—Horizontal gain. Horizontally expands pattern.

V.G. (A of figure 3–11)—Vertical gain. Vertically expands pattern.

H.D. (B of figure 3–11)—Horizontal distortion. Corrects horizontal distortion of the circular pattern.

V.D. (D of figure 3–11)—Vertical distortion. Corrects vertical distortion of the circular pattern.

H.S. (F of figure 3–11)—Horizontal symmetry. Lobe slope symmetry at 90° and 270°.

V.S. (K of figure 3–11)—Vertical symmetry. Lobe slope symmetry at 0° to 180°.

P.S. (H of figure 3–11)—Pattern symmetry. Identical slopes of diagonal lobes.

PH. (C of figure 3–11)—Phase. Provides 90° separation of cardinal points.

CAL. (L of figure 3–11)—Controls the diameter of the calibration pattern to provide that the calibration and circular patterns have same diameter.

b. INITIAL CONTROL POSITIONS.—With the equipment completely installed as in Section 3, paragraph 3, place the POWER ON-OFF switch (12 of figure 3–11) in the ON position, and permit the equipment to warm up for at least 1 hour before proceeding with the calibration adjustments. Turn the BRILLIANCY control counterclockwise (at minimum position) during the warm up.

Throughout the entire calibration set-up procedure the R-F SENS control (6 of figure 3–11) should be set at minimum (fully counterclockwise) and left in that position. All other controls should be set at the midpoint of the potentiometer travel until this procedure directs their readjustment.

c. CALIBRATION-PATTERN SPOT CENTERING.

(1) With the POWER switch ON and CALIBRATE-SENSE switch in neutral position, observe that a small spot of light appears on the screen somewhere near the center. If, after a reasonable warm-up period, this spot does not appear, rotate the BRILLIANCY control until the spot is visible.

CAUTION

TO PREVENT POSSIBLE DAMAGE TO THE CATHODE-RAY TUBE SCREEN DO NOT LEAVE THE "BRILLIANCY" CONTROL IN THE FULLY CLOCKWISE POSITION FOR MORE THAN A FEW SECONDS.

(2) Turn on the MOTOR switch and use the FOCUS control to bring the resulting circle into sharp, clear focus. Too much brilliancy will cause distortion in lines, and the BRILLIANCY and FOCUS controls must be used together. Do not expect the figure to be a good circle at this stage.

(3) Place the CALIBRATE-SENSE switch in the CALIBRATE position. The circular pattern will now be replaced by a 36-lobe "daisy" pattern. This is the calibration pattern whose center point or spot should now be centered.

(4) Note the very small etched ring in the center of the cursor screen and place the calibration spot in the exact center of the screen by positioning it within this ring. The screwdriver controls V.C. and H.C. are used to move the spot to the desired position. Parallax errors may be avoided by placing the reflected image of the eye used in sighting directly in the center of the screen as shown in figure 3–13. Accuracy in centering this spot will save trouble later.

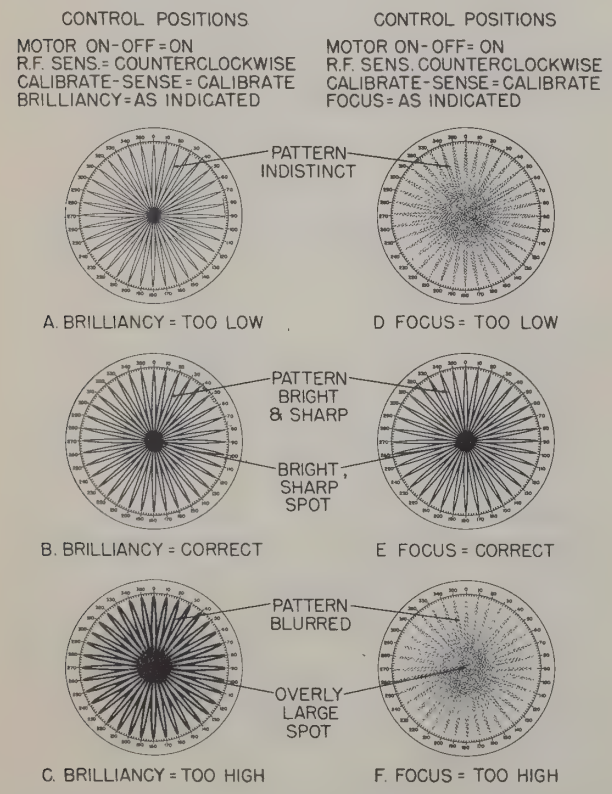


Figure 3–12. Adjustment of Brilliancy and Focus

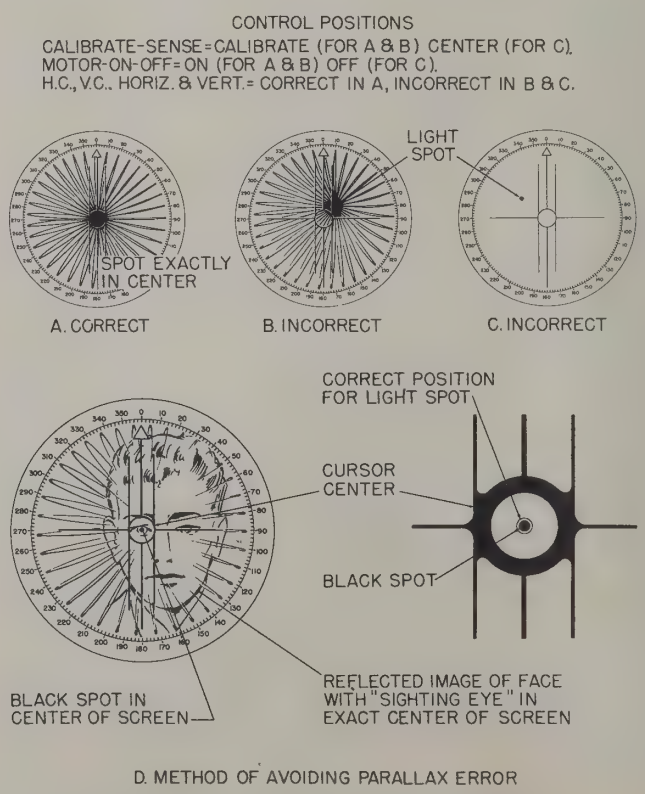

CONTROL POSITIONS
CALIBRATE-SENSE=CALIBRATE (FOR A & B) CENTER (FOR C).
MOTOR-ON-OFF=ON (FOR A & B) OFF (FOR C).
H.C., V.C., HORIZ. & VERT.=CORRECT IN A, INCORRECT IN B & C.
LIGHT SPOT
SPOT EXACTLY IN CENTER
A. CORRECT
B. INCORRECT
C. INCORRECT
CORRECT POSITION FOR LIGHT SPOT
CURSOR CENTER
BLACK SPOT
BLACK SPOT IN CENTER OF SCREEN
REFLECTED IMAGE OF FACE WITH "SIGHTING EYE" IN EXACT CENTER OF SCREEN
D. METHOD OF AVOIDING PARALLAX ERROR

Figure 3–13. Spot Centering

d. SETTING OF CIRCLE DIAMETER AND SHAPE.

(1) Turn the motor OFF and place the CALIBRATE-SENSE switch in the neutral position. Center the spot now on the screen by using the HORIZ. and VERT. controls, in the same manner as the calibration spot was centered in *c.*(4).

(2) Turn the motor on and observe figure on the screen. By means of the V.G. and H.G. screwdriver controls spread the figure to make it as circular as possible.

(3) Adjust V.G. and H.G. further to bring the figure as near to the azimuth scale as possible. It may be necessary to use the CIRCLE DIA. control to achieve a circle which touches the scale, and this should be done rather than turning either gain control fully clockwise.

(4) The figure now on the screen will probably be a circle distorted on one or both axes, an example of which condition is shown in figure 3–14. While this is a good possibility, distortion has other ramifications. Flats may appear on the periphery of the circle or elongations may be evident. The controls V.D. and H.D. are used to correct these conditions.

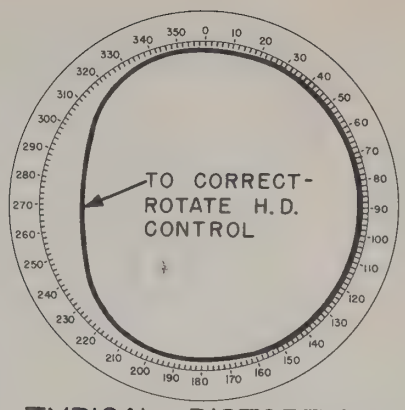
(5) Flats may be eliminated by rotating the applicable control (V.D. for flats on top or bottom of circle and H.D. for flats on right or left of circle) until curvature results. Figure 3–14 demonstrates a particular instance of distortion, along with the proper corrective measure. A near-perfect circle may be impossible to attain, but this condition does not seriously affect the accuracy of D/F bearings.

Note

Since it is impossible to obtain a perfect circle, a good figure may be one which is slightly flat at each cardinal point (0°, 90°, 180° and 270°) and which has *equal radii* at these points. *If the circular figure has a flat on its periphery which causes the radius at that point to vary from the longest radius by as much as 1/8 of an inch, it is necessary to replace one of the modulator tubes. The characteristics of individual tubes vary, and each pair of modulators (horizontal pair and vertical pair) must be exactly balanced. This condition can be reached only by selecting tubes. Alignment procedure when tube selection is indicated is described in Section 7, paragraph 2a(3)(b).*

e. SETTING PATTERN DIAMETERS.—It is now necessary to make the circle and calibration pattern diameters equal.

(1) With the CALIBRATE-SENSE switch in center position, motor ON, adjust the CIRCLE DIA. control so that the circular figure just touches the edge of the azimuth scale.



TYPICAL DISTORTION AND CORRECTION.

Figure 3–14. Elimination of Flats with Distortion Control

(2) Place the CALIBRATE-SENSE switch in the CALIBRATE position and note the size of the pattern.

(3) With the CAL screwdriver control make the circle and calibration diameters equal. It may be necessary to flip the CALIBRATE-SENSE switch from CALIBRATE to center several times to accomplish this. (See figure 3–15 for proper adjustment.)

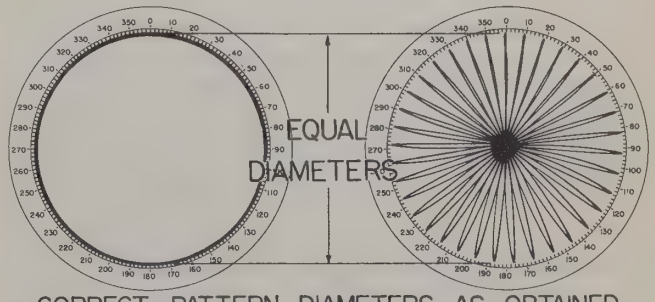
Note

The CIRCLE DIA. control changes the diameter of both the circular and calibration patterns, but does *not* change the *relative* diameters. The CAL control changes the diameter of the calibration pattern only.

(4) Check centering of the calibration-pattern spot, and, if it is not centered, center with V.C. and H.C. Turn MOTOR OFF and check spot. If not centered, center with HORIZ. and VERT.

f. SYMMETRY OF LOBES AND PATTERN.

(1) Turn motor ON and place CALIBRATE-SENSE switch in CALIBRATE position.



CORRECT PATTERN DIAMETERS AS OBTAINED BY ADJUSTMENT OF CIRCLE DIA. AND CAL.

Figure 3–15. Adjustment of CIRCLE DIA. and CAL.

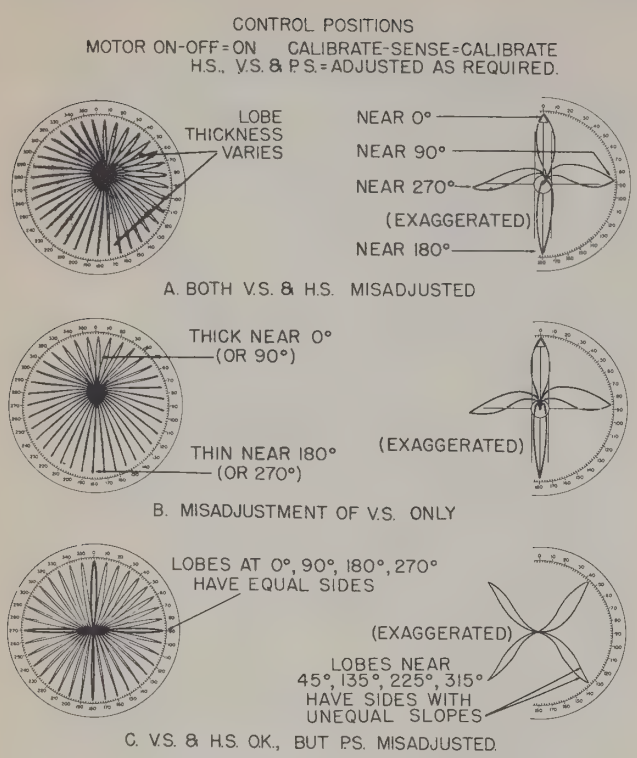

CONTROL POSITIONS
MOTOR ON-OFF=ON CALIBRATE-SENSE=CALIBRATE
H.S., V.S. & P.S.=ADJUSTED AS REQUIRED.
LOBE THICKNESS VARIES
NEAR 0°
NEAR 90°
NEAR 270°
(EXAGGERATED)
NEAR 180°
A. BOTH V.S. & H.S. MISADJUSTED
THICK NEAR 0° (OR 90°)
THIN NEAR 180° (OR 270°)
(EXAGGERATED)
B. MISADJUSTMENT OF V.S. ONLY
LOBES AT 0°, 90°, 180°, 270° HAVE EQUAL SIDES
(EXAGGERATED)
LOBES NEAR 45°, 135°, 225°, 315° HAVE SIDES WITH UNEQUAL SLOPES
C. V.S. & H.S. OK., BUT P.S. MISADJUSTED.

Figure 3–16. Symmetry of Lobes and Pattern

(2) Considering the lobes whose tips are on or adjacent to the 0° and 180° marks, adjust the V.S. control until the sides of each lobe have equal slopes. (Use of the cursor pointer line as a bisector is mentioned here, but is not specifically recommended. Some operators may prefer to use this as a gauge to assist in lining up the sides of the lobes to attain equal slopes.) The *thickness or slope of the 0° lobe* need not be equal to that of the *180° lobe,* but the *two sides* of *any one* lobe must be nearly equal. Thus symmetry about the vertical center-line or bisector of the lobes is obtained. (See figure 3–16 B and C.)

(3) Perform a similar adjustment on the lobes whose tips are near the 90° and 270° marks on the azimuth scale. Use the H.S. control to make the sides of the lobes have equal slopes. (See figure 3–16 C, left.)

(4) Repeat steps *f.*(1) and *f.*(2) for fine adjustment. If fine adjustment is not possible, it may be necessary to recenter the spot by turning the motor OFF and adjusting the HORIZ. and VERT. controls to bring it to the exact center.

(5) ADJUSTMENT OF P.S. CONTROL.

(a) Turn the motor ON and place the selector switch in the CALIBRATE position. It will be noticed that the lobes of the pattern which fall near 45°, 135°, 225°, and 315° have asymmetrical sides; that is, the distance from a point on a side to the bisector of the lobe is different from the distance to the bisector from a point opposite on the other side of the lobe. (See figure 3–16 C, right.)

(b) Adjust P.S. to make the lobes of the pattern symmetrical. An indication of correct adjustment is that condition wherein the light spot at the center of the pattern is reduced to its smallest size by the P.S. control. Movement of this control in one direction first shortens the spot along one axis, then elongates it on the other. The correct position is reached when the spot is shortest on both axes. Final check is symmetry within lobes. Thickness of lobes is as uniform at this point as is possible to attain. This condition is shown in figure 3–17A.

g. FINAL ADJUSTMENTS. (Motor ON, selector switch to CAL.)

(1) With HORIZ. and VERT. adjust the calibration pattern so that the lobe near 0° and the lobe near 180° differ from their reference points by the same amount. (If the lobe near 0° falls at 3°, the lobe near 180° must fall on 183°.) Adjust the lobes near the horizontal points (90° and 270°) in the same manner and recheck the points on both axes. The horizontal and vertical axes need not have equal deviations; that is, they do not have to be 90° apart at this stage.

CAUTION

It is easy to have the wrong number of lobes in one quadrant and accordingly have a misleading calibration pattern. By counting the number of lobes in any two quadrants, this difficulty may be avoided. In every quadrant there must be 10 lobes, including the two lobes on or near the cardinal points of the quadrant.

(2) Adjust the PH control to bring the vertical and horizontal axes *exactly* 90° apart. This is a very important and critical adjustment. (See figure 3–17B for proper adjustment.)

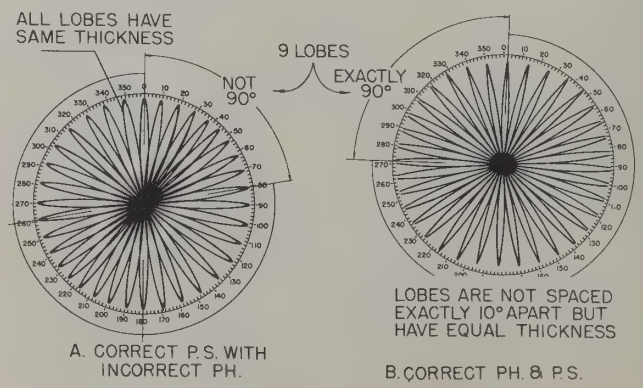

ALL LOBES HAVE SAME THICKNESS
NOT 90°
A. CORRECT P.S. WITH INCORRECT PH.
9 LOBES
EXACTLY 90°
LOBES ARE NOT SPACED EXACTLY 10° APART BUT HAVE EQUAL THICKNESS
B. CORRECT PH. & P.S.

Figure 3–17. Adjustment of PH. Control

(3) Set the HG control to bring all lobes within the prescribed deviation tolerance.

IMPORTANT

Calibration accuracy should be held to less than 4° error-spread. By error-spread is meant the amount of deviation of calibration-pattern lobes from their nearest 10° points. (Table 3–1 explains error-spread more fully.) This deviation is found by comparing differences of any series of lobes to their nearest 10° points algebraically. Thus, if the algebraic difference between any two lobes around the azimuth scale and their nearest 10° points exceeds 4°, the calibration pattern should be corrected. With proper selection of tubes and careful adjustment of controls during calibration it is possible to obtain an error-spread as low as 2°. However, this spread is *never* to exceed 4°.

TABLE 3–1. SPREAD COMPARISON TO DETERMINE DEVIATION

LOBE POSITION	NEAREST 10° POINT	DEVIATION
2°	0°	2
10°	10°	0
19°	20°	—1
28°	30°	—2*
40°	40°	0
51°	50°	1
62°	60°	2
73°	70°	3†
82°	80°	2
92°	90°	2

* —2 } 3—(—2)=5, which exceeds maximum permissible deviation.
† +3 }

(4) In case the setting of step (3) affects the pattern diameter considerably, manipulate the CIRCLE DIA. control to bring the pattern to the proper size.

(5) When the set has been operating for about 24 total hours, check the calibration again, because the electrical characteristics of the modulator tubes are likely to change slightly during this time. After 24 hours of operation, they may be considered "aged" and will not change characteristics further until their useful life begins to fail.

b. ZERO ADJUSTMENT.—With the target transmitter located exactly on the reference line and the receiver adjusted for a propeller-blade bearing pattern, the cathode-ray tube clamp is adjusted to position the

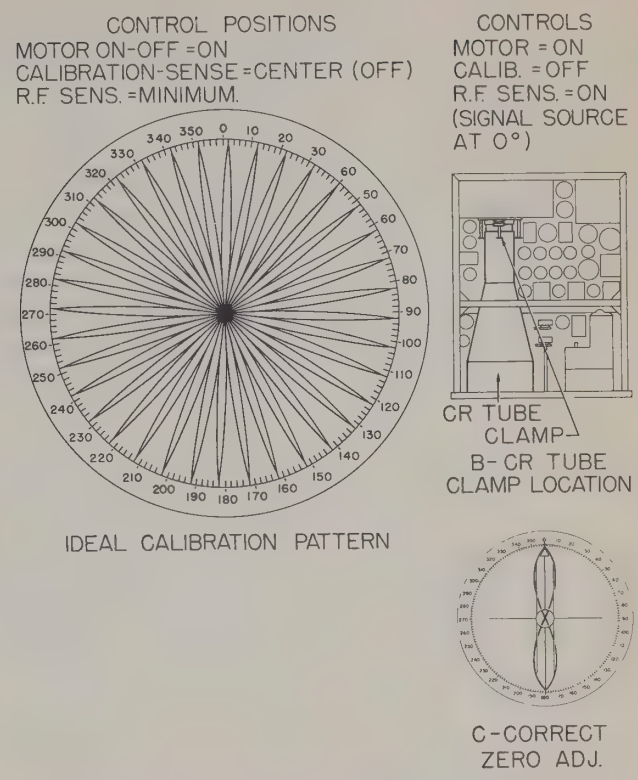


Figure 3–18. Ideal Calibration Pattern and D/F Pattern Zeroing

tip of the propeller-blade pattern exactly on the 0° of the azimuth scale (see figure 3–18C) as follows:

(1) With Radio Transmitter T–207A/URD–2 located exactly on the reference line, produce an unmodulated signal by placing the OFF-CW-MCW switch in the CW position.

(2) With the MOTOR ON-OFF switch in the ON position and the CALIBRATE-SENSE switch in the center (off) position, adjust the R.F. SENS. control and the tuning dial (11 of figure 3–11) until the propeller-blade pattern (representing the target transmitter) appears on the screen. Ascertain that the propeller-blade pattern is the result of the target transmitter by turning the transmitter modulation on and off (OFF-CW-MCW switch alternately at MCW and CW) and noting that the modulation characteristic disappears and reappears on the pattern. Then lock the tuning dial with the LOCK (13 of figure 3–11). It may be necessary to adjust the BRILLIANCY and FOCUS controls to obtain a clear, sharp pattern. Adjustment of the R.F. SENS. control will help produce a pattern which has the correct shape for bearing readings.

(3) Rotate the operating ring to place the arrow of the cursor at *exactly* 0° on the azimuth scale.

(4) Locate the knurled locking knob on the cathode-ray tube clamp (see figure 3–18). The cathode-

ray tube clamp is reached by removing the receiver from the cabinet, and is located on the top of the chassis beside the high-voltage compartment.

(5) Loosen the locking knob, rotate the cathode-ray tube clamp until the propeller-blade pattern is exactly on 0° (see figure 3–18C), and tighten the locking knob on the clamp. If the antenna elements are not parallel, the propeller-blade pattern may be slightly bent. Two methods of obtaining bearings with bent propeller patterns are possible. The best method is to make the pattern symmetrical about the cursor, and the other method is to take the readings at the two tips of the pattern, and then take the average of the two readings. Thus, the 0° indexing must be made with respect to the bearing reading method which is to be employed. That is, if bearings will be taken when the pattern is symmetrical about the cursor, the cathode-ray tube clamp is rotated until the pattern is symmetrical about the cursor. If the propeller-blade pattern is a perfect propeller shape, however, the clamp is rotated until the *tips* of the pattern are bisected by the cursor (see figure 3–18C).

(6) Reassemble the receiver into the cabinet and again check the bearing.

7. INSTALLATION CALIBRATION.

During the following calibration procedure, no one should stand within 20 feet around the D/F antenna assembly, nor within eight feet down from the D/F antenna assembly, and no one should stand near the transmitting antenna, to keep from distorting the reception or the antenna radiation pattern.

a. TRANSMITTER CONTROL POSITIONS. — Mount Radio Transmitter T–207A/URD–2 on Tripod CBJO–10610 (see figure 3–9). Place the OFF-CW-MCW switch in the CW position, and note if the meter deflects. If no meter reading is obtained, the batteries may not have been installed (refer to Section 3, paragraph 4).

b. RECEIVER CONTROL POSITIONS.—On Radio Receiver R–256A/URD–2, place the POWER ON-OFF switch at ON, the CALIBRATE-SENSE switch at CALIBRATE, the MOTOR ON-OFF switch at ON,

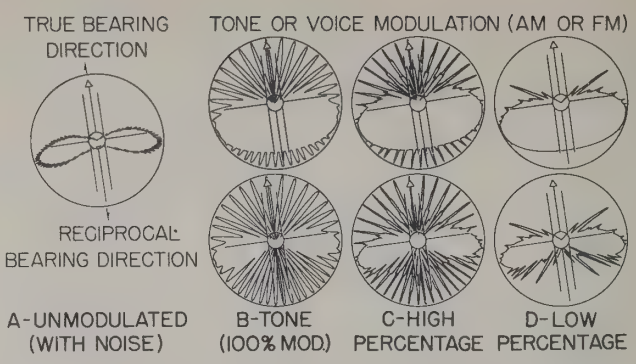


Figure 3–19. Typical Sense Patterns

and note if a correct calibration pattern is obtained. If the lobes of the calibration pattern are 10° apart, place the CALIBRATE-SENSE switch at center, unlock the tuning dial, and rotate the tuning dial until the propeller-blade pattern, representing the target transmitter, appears on the screen. Adjust the R.F. SENS. control for a good pattern.

c. CHECK OF SENSE.—Place the CALIBRATE-SENSE switch in the SENSE position and note if the pattern changes shape. When tuned to an unmodulated signal (such as the target transmitter), the half of the screen in which no sense shape appears is the true-bearing direction. Modulation will change the shape of the sense pattern and some typical sense patterns and the resultant true-bearing directions are shown in figure 3–19. For further information about sense patterns, refer to Section 4, paragraph 5.

d. CORRECTION OF CALIBRATION.—After the 0° to 180° line has been set to read either North-South or fore-aft, the system may be plotted by flying a wide circle (10 miles) around the site, tracking the plane either with radar or pelorus. Record radar or optical bearings and corresponding D/F indicated bearings, and make a correction chart or table. This should be done at several frequencies separated by 5-mc intervals across the band to be used. This calibration correction should be made whenever the equipment is moved to a new site.

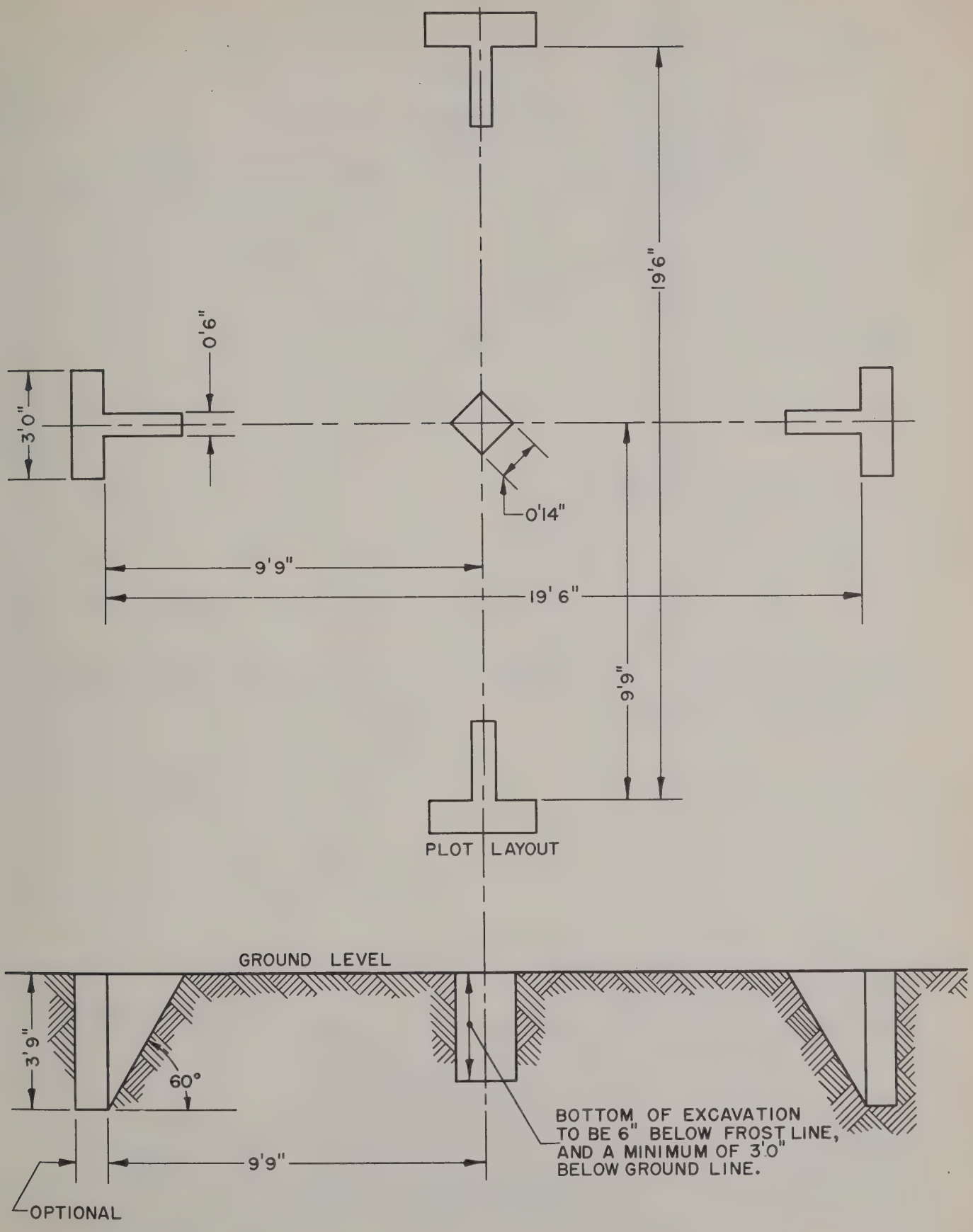


Figure 3–20. Excavation Layout

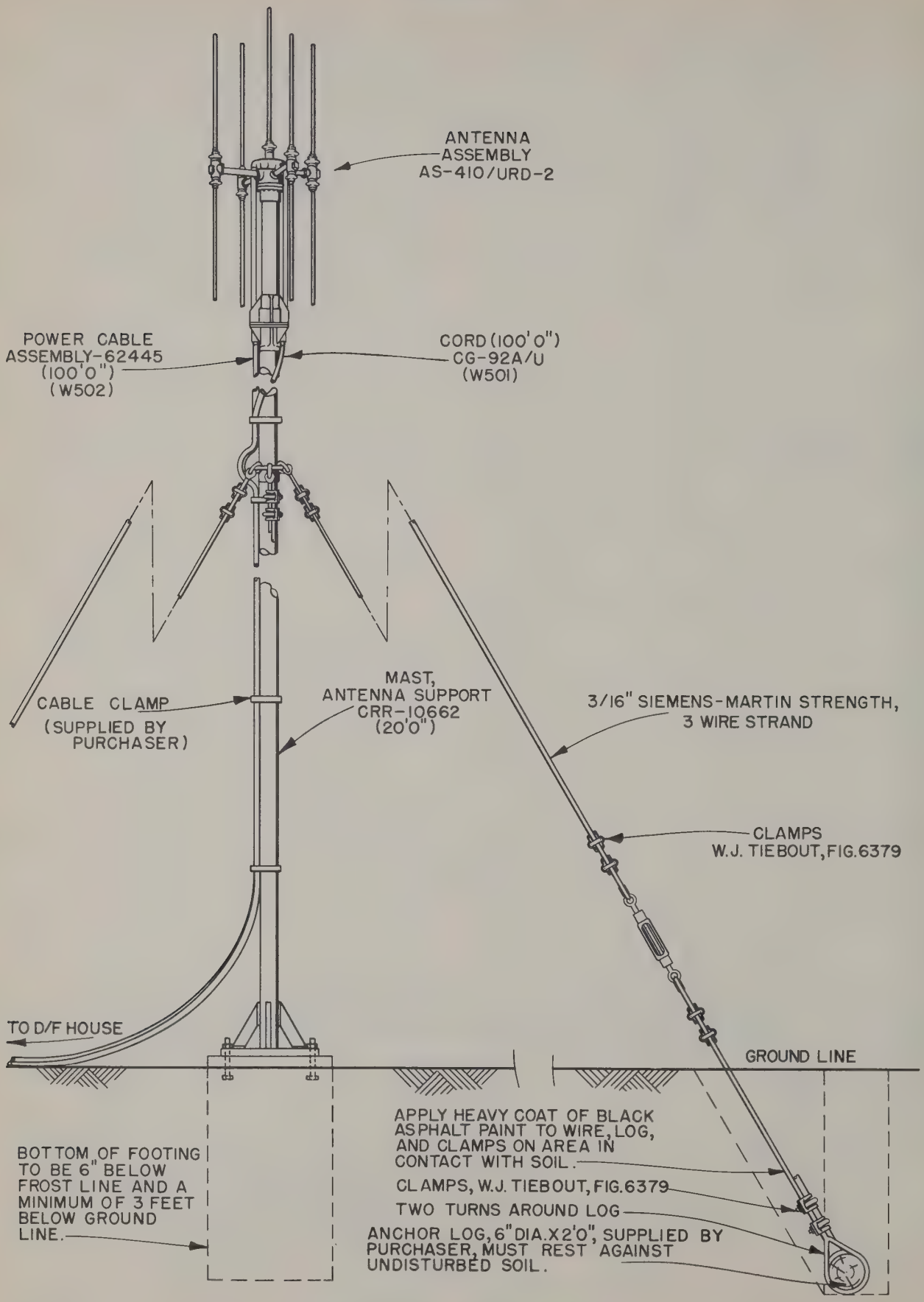

ANTENNA ASSEMBLY AS-410/URD-2
POWER CABLE ASSEMBLY-62445 (100'0") (W502)
CORD (100'0") CG-92A/U (W501)
CABLE CLAMP (SUPPLIED BY PURCHASER)
MAST, ANTENNA SUPPORT CRR-10662 (20'0")
3/16" SIEMENS-MARTIN STRENGTH, 3 WIRE STRAND
CLAMPS W.J. TIEBOUT, FIG.6379
TO D/F HOUSE
GROUND LINE
APPLY HEAVY COAT OF BLACK ASPHALT PAINT TO WIRE, LOG, AND CLAMPS ON AREA IN CONTACT WITH SOIL.
CLAMPS, W.J. TIEBOUT, FIG.6379
TWO TURNS AROUND LOG
ANCHOR LOG, 6" DIA. X 2'0", SUPPLIED BY PURCHASER, MUST REST AGAINST UNDISTURBED SOIL.
BOTTOM OF FOOTING TO BE 6" BELOW FROST LINE AND A MINIMUM OF 3 FEET BELOW GROUND LINE.

Figure 3–21. Antenna Installation

SECTION 4
OPERATION

1. GENERAL OPERATIONAL PROCEDURE.

a. TURNING EQUIPMENT ON.—To turn equipment on, place the POWER ON-OFF switch (12 of figure 4–1) in the ON position. Prior to operation of the equipment, a warm-up period of approximately 10 minutes is desirable. A detailed description of the controls is given in Section 4, paragraph 2.

b. CHECKING CALIBRATION.—The calibration pattern should be checked periodically ***but it need not be checked each time a bearing is to be taken.*** A detailed description of calibration is given in Section 4, paragraph 3, and a simplified procedure is as follows:

(1) Place the controls as listed below;

POWER ON-OFF (12 of figure 4–1)—ON
MOTOR ON-OFF (10 of figure 4–1)—ON
R.F. SENS. (6 of figure 4–1)—counterclockwise
CALIBRATE-SENSE (14 of figure 4–1)—CALIBRATE
Other controls—unimportant (at this time)

(2) A 36-lobe calibration pattern (such as shown in figures 4–2A through 4–2E) will appear on the screen (20 of figure 4–1). It may be necessary to press in, and adjust the FOCUS (2 of figure 4–1) and BRILLIANCY (3 of figure 4–1) controls to obtain a sharp, bright pattern.

CAUTION

DO NOT PLACE THE "BRILLIANCY" CONTROL IN THE MAXIMUM (FULLY CLOCKWISE) POSITION.

(3) Note if the 36-lobes of the calibration pattern are 10° apart. That is, if the first lobe (lobe nearest 0°) is at 2°, the next lobe should be at 12° (2° + 10°), the following at 22° (2° + 20°), the next at 32° (2° + 30°), the next at 42° (2° + 40°), and so forth until 352° (2° + 350°) is reached. This correct calibration pattern is shown in figure 4–2A, and if it is not obtained, read the following steps *b.*(4), *b.*(5), or *b.*(6).

(4) If the lobe separation cannot be determined because the pattern is too large or too small (figure 4–2E), press in and adjust the CIRCLE DIA. (8 of figure 4–1) control until the tips of the lobes just touch the edge of the azimuth scale (16 of figure 4–1), then refer to the above step *b.*(3).

(5) If the calibration is only slightly off and is correct at the four cardinal points (0°, 90°, 180° and 270°), the HORIZ. (4 of figure 4–1) or the VERT. (1 of figure 4–1) controls (see figures 4–2*b* and 4–2C) may require adjustment. Press in and adjust the HORIZ. and VERT. controls until the conditions of step *b.*(3) are satisfied.

(6) If the pattern is very much distorted (as shown in figure 4–2D), the screwdriver controls must be adjusted as described in Section 3, paragraph 6. Ascertain that this is really the cause of incorrect calibration before proceeding with the calibration adjustments of Section 3.

c. OBTAINING DIRECTION-FINDING PATTERN.—A detailed description of the direction-finding pattern and its limitations and accuracies may be found in Section 4, paragraph 4. The following is a simplified procedure for obtaining the direction-finding propeller-shaped pattern.

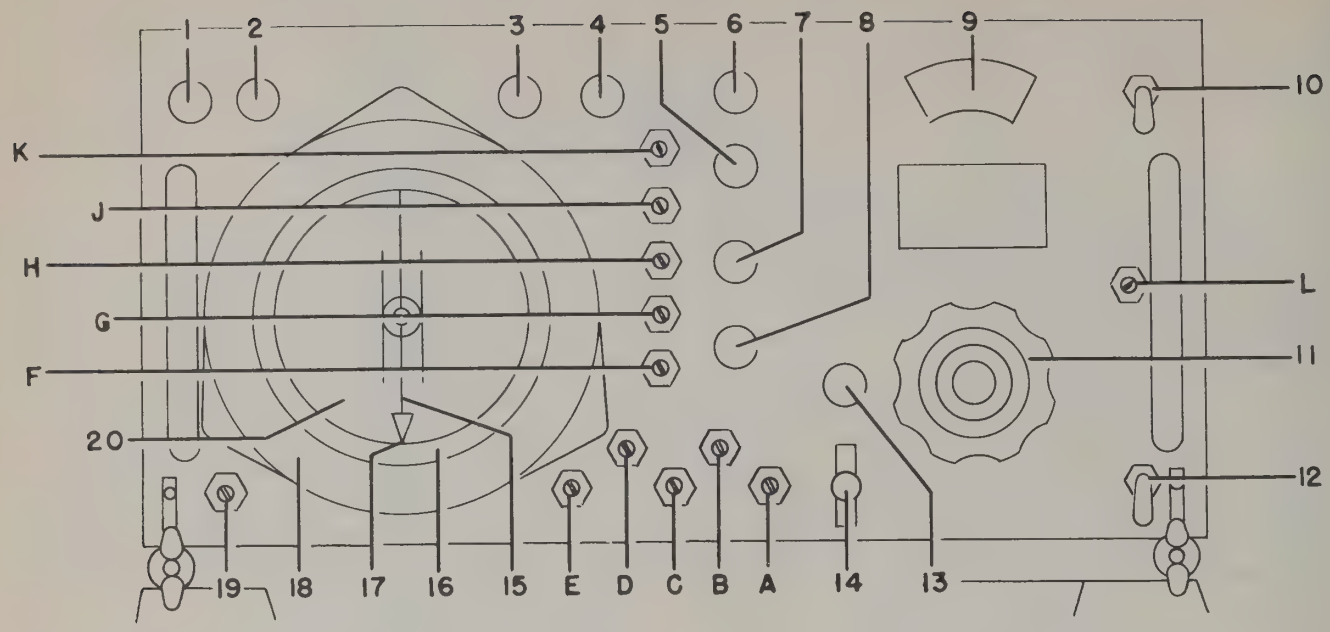
(1) Place the controls as listed below:

POWER ON-OFF (12 of figure 4–1)—ON
MOTOR ON-OFF (10 of figure 4–1)—ON
CALIBRATE-SENSE (14 of figure 4–1)—center (off)
LOCK (13 of figure 4–1)—unlock
LIGHTS (5 of figure 4–1)—adjust as required
R.F. SENS. (6 of figure 4–1)—use in step *c.*(2)
Tuning dial (11 of figure 4–1)—use in step *c.*(2)
Other controls—do not adjust

(2) Rotate the tuning dial (11 of figure 4–1), and adjust the R.F. SENS (6 of figure 4–1) until a propeller-shaped D/F pattern appears on the screen (20 of figure 4–1). The pattern obtained will resemble one of the patterns of figures 4–2F through 4–2T. A study of these illustrations will indicate the required adjustment of the indicated controls to produce a good direction-finding pattern.

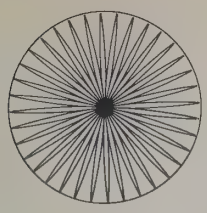
d. OBTAINING SENSE PATTERN.—A detailed description of sense patterns may be found in Section 4, paragraph 5, and a simplified procedure for obtaining the sense of direction follows:

(1) Obtain the propeller-shaped direction-finding pattern of step *c.* This pattern indicates the line-of-

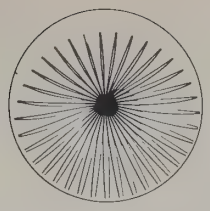


NO.	NAME OF CONTROL	TYPE	FUNCTION AND REMARKS
1	VERTical	Oper-calib.	Press-to-rotate. Moves pattern for 10° separation.
2	FOCUS	Operation	Press-to-rotate. Adjust for sharp pattern.
3	BRILLIANCY	Operation	Press-to-rotate. Adjust for bright pattern.
4	HORIZontal	Oper-calib.	Press-to-rotate. Moves pattern for 10° separation.
5	LIGHTS	Operation	Illumination of 9 and 16.
6	R.F. SENSitivity	Operation	Shapes D/F propeller pattern. Radio freq. gain.
7	AUDIO GAIN	Operation	Audio volume control.
8	CIRCLE DIAmeter	Both	Press-to-rotate. Adjust to make pattern touch 16.
9	MEGACYCLES	Operation	Indicates operating frequency. Rotated by 11.
10	MOTOR ON-OFF	Operation	"OFF" for audio reception. (Simultaneous at "ON.")
		Both	"ON" for patterns. (17 controls type of pattern.)
11	Tuning dial	Operation	Selects equipment operating frequency. Moves 9.
12	POWER ON-OFF	Both	Turns complete AN/URD–2A equipment ON or OFF.
13	LOCK	Operation	Locks 11 to prevent accidental adjustment.
14	CALIBRATE-SENSE	Calibration	"CALIBRATE" for 36-lobe calibration pattern.
		Operation	Center for D/F propeller-shaped pattern.
		Operation	"SENSE" for indication of true-bearing direction.
15	Cursor	Both	For bisecting or aligning patterns.
16	Azimuth scale	Operation	Indicates bearing when pattern is symmetrical to 15.
17	Arrow	Operation	Points to bearing on 16.
18	Operating ring	Operation	Rotates 15 and 17 for aid in obtaining bearings.
19	PHONES	Operation	Headset jack for audio reception.
20	Screen	Operation	Carries 15 and 17 and neutralizes effect of light.
A	V.G. (vert. gain)	Calibration	Screwdriver adjustment. Vertically expands pattern.
B	H.D. (distortion)	Calibration	Screwdriver adjustment. Corrects horizontal distortion.
C	P.H. (phase)	Calibration	Screwdriver adjustment. Phase correction (90° sep.)
D	V.D. (distortion)	Calibration	Screwdriver adjustment. Corrects vertical distortion.
E	H.G. (hor. gain)	Calibration	Screwdriver adjustment. Horiz. expands pattern.
F	H.S. (symmetry)	Calibration	Screwdriver adjustment. Horizontal symmetry.
G	H.C. (center)	Calibration	Screwdriver adjustment. Horiz. centering of spot.
H	P.S. (pat. sym.)	Calibration	Screwdriver adjustment. Symmetry of pattern.
J	V.C. (center)	Calibration	Screwdriver adjustment. Vert. centering of spot.
K	V.S. (symmetry)	Calibration	Screwdriver adjustment. Vertical symmetry.
L	CAL.	Calibration	Screwdriver adjustment. Calibration pattern diameter.

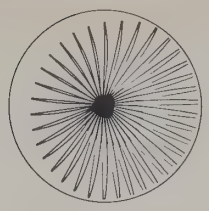
Figure 4–1. Radio Receiver R-256/URD—2, Front Panel Controls



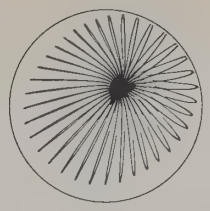
A-CORRECT CALIBRATION PATTERN



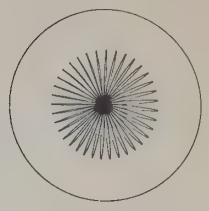
B-MALADJUSTED "VERTICAL" CONTROL



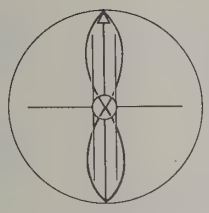
C-MALADJUSTED "HORIZONTAL" CONTROL



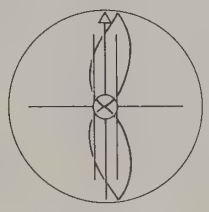
D-MALADJUSTED SCREWDRIVER CONTROL



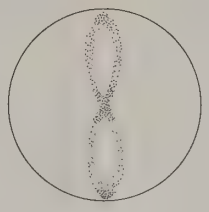
E-MALADJUSTED "CIRCLE DIAMETER" CONTROL



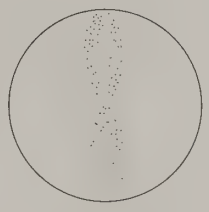
F-CORRECT (DESIRABLE) D/F PATTERN



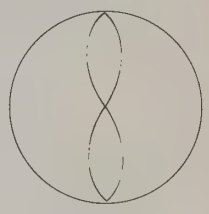
G-BENT D/F PATTERN



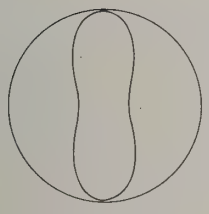
H-MALADJUSTED "FOCUS" OR "BRILLIANCY" (TOO HIGH)



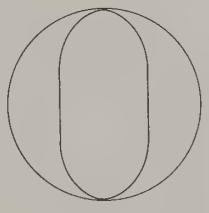
I-MALADJUSTED FOCUS



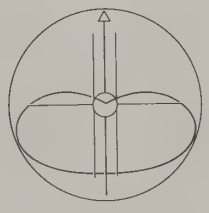
J-MALADJUSTED "BRILLIANCY" (TOO LOW)



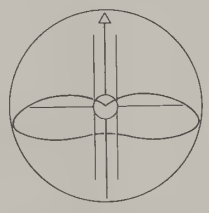
K-NOT TUNED TO FREQUENCY OR R.F. SENS TOO LOW



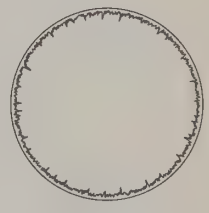
L-NOT TUNED TO FREQUENCY OR R.F. SENS TOO LOW



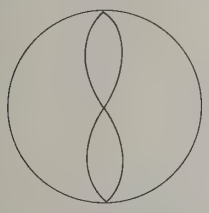
M-LOW FREQUENCY SENSE. ALSO LOW R.F. SENS OR POOR TUNING



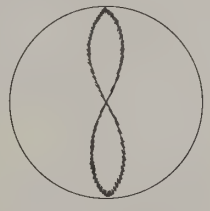
N-HIGH FREQUENCY SENSE. ALSO HIGH R.F. SENS. OR POOR TUNING



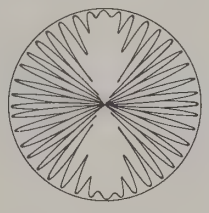
O-CIRCULAR (NO SIGNAL) PATTERN WITH NOISE



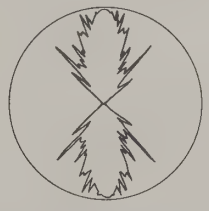
P-NOISE-FREE UNMODULATED SIGNAL



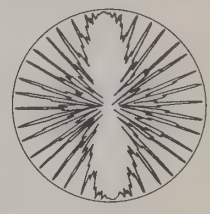
Q-NOISE MODULATED SIGNAL



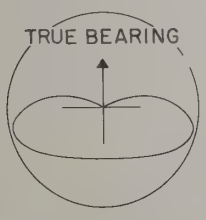
R-TONE MODULATED SIGNAL

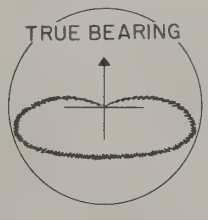


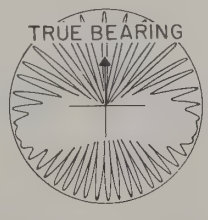
S-FREQUENCY MODULATED SIGNAL



T-VOICE MODULATED SIGNAL







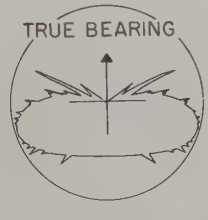


Figure 4–2. Typical Operational Patterns

direction of the received signal, and consequently does not show which is the true and which the reciprocal bearing.

(2) Press and hold the CALIBRATE-SENSE (14 of figure 4–1) switch in the SENSE position. The propeller-shaped pattern will be replaced by a pattern resembling one of those shown in figures 4–2M, 4–2N, 4–2P, 4–2Q, 4–2R, 4–2S, or 4–2T. The true bearing direction will be in the portion of the screen which contains no pattern when the SENSE switch is operated.

e. FINDING BEARING.—Detailed direction-finding operational information may be found in Section 4, paragraph 6, and a more simplified procedure is as follows:

(1) The control positions for direction finding are as follows:

POWER ON-OFF (12 of figure 4–1)—ON
MOTOR ON-OFF (10 of figure 4–1)—ON
CALIBRATE-SENSE (14 of figure 4–1) as follows
Other controls—as required

(2) Obtain the propeller-shaped pattern (of step *c*) by placing the CALIBRATE-SENSE switch in the center position.

(3) Obtain the sense pattern (of step *d*) by holding the CALIBRATE-SENSE switch in the SENSE position. Rotate the operating ring (18 of figure 4–1) so that the arrow (17 of figure 4–1) is in the half of the screen in which no pattern appears (figures 4–2P through 4–2T).

(4) Place the CALIBRATE-SENSE switch in the center position and rotate the operating ring so that the direction-finding pattern is symmetrical about the cursor (15 of figure 4–1). Figure 4–3 shows the methods of aligning the cursor with three types of patterns.

(5) Read the bearing where the arrow touches the azimuth scale (16 of figure 4–1). Consult a bearing correction chart or table (if one has been made) to obtain the correct bearing.

(6) Audio reception for identification of the received signal may simultaneously be obtained by plugging a 600-ohm impedance headset into the PHONES jack (19 of figure 4–1) and adjusting the AUDIO GAIN (7 of figure 4–1) control.

(7) The frequency of the received signal may be read on the MEGACYCLES dial (9 of figure 4–1), and the tuning dial may be locked with the LOCK (13 of figure 4–1) knob.

f. AUDIO RECEPTION.—Audio reception may be simultaneous with direction-finding with the MOTOR ON-OFF switch in the ON position, or may be a separate function (for communication) with the MOTOR ON-OFF switch at OFF.

2. FRONT PANEL CONTROLS.

The front panel contains three types of controls: operation controls which are adjusted for direction finding and aural reception of signals, press-to-rotate controls which are adjusted to improve the direction-finding pattern, and screwdriver adjustment controls which must never be adjusted during operation and must be adjusted only when absolutely necessary after consulting Section 3, paragraph 6.

a. OPERATIONAL CONTROLS.—The following is a description of the controls which are normally adjusted during operation:

POWER ON-OFF (12 of figure 4–1)—This switch controls the primary power source (117v a-c) and thereby turns the complete AN/URD–2A equipment on or off.

MOTOR ON-OFF (10 of figure 4–1).—This switch controls the motor in the antenna assembly and consequently controls the function of the equipment. When this switch is in the OFF position, the equipment functions as a communication receiver and the pattern on the screen (20 of figure 4–1) is a spot of light. When this switch is in the ON position, the equipment functions as a direction finder with simultaneous audio reception and the pattern on the screen will be either a circle, a 36-lobe "daisy" shaped calibration pattern, a "propeller" shaped direction-finding pattern (distorted with modulation), or a sense pattern depending upon the position of the CALIBRATE-SENSE switch and the signal being received.

CALIBRATE-SENSE (14 of figure 4–1).—This is a three-position toggle switch. The SENSE position is non-locking and must be held in this position; the CALIBRATE position is locking and will remain when placed in this position, and the center is the off position and also is a locking position. When placed in the center position, the pattern will be a circle if no r.f. is being received, and will be a pattern resembling a propeller or a distorted propeller, or a pattern in which the dark area resembles a propeller when the equipment is tuned to an r-f signal (see figures 4–2F to 4–2T, inclusive). When the switch is held in the SENSE position, the propeller-shaped pattern changes to indicate the direction of the true bearing (see figures 4–2P through 4–2T). When the switch is placed in the CALIBRATE position, a 36-lobe "daisy" shaped pattern appears on the screen and this pattern is periodically checked to ascertain that the circuits are in proper balance to provide accurate direction-finding information (see figures 4–2A to 4–2E).

Tuning dial (11 of figure 4–1).—This knob rotates the tuning capacitors and the MEGACYCLES dial to select the operating frequency of the equipment. As the tuning dial is rotated to tune the equipment, the circular pattern begins to flatten on two sides (figures 4–2K and 4–2L) until it assumes a (2-lobed) shape resembling a propeller (if received signal is unmodulated), or some type of direction-finding pattern (see figures 4–2P through 4–2T) with one lobe pointing (on the azimuth scale) to the true bearing and one lobe pointing to the reciprocal bearing. Therefore, to obtain a good direction-finding pattern, it is necessary to carefully adjust the tuning dial to the exact frequency of the received signal.

R.F. SENS. (6 of figure 4–1).—This knob controls the r-f gain of the equipment and consequently aids in obtaining good patterns (compare figures 4–2K and 4–2L with 4–2P).

Operating ring (18 of figure 4–1).—The operating ring is a movable ring around the periphery of the azimuth scale, and may be rotated to position the cursor to bisect the pattern for direction-finding information.

Screen (20 of figure 4–1).—The screen is a green-tinted Plexiglas window over the face of the cathode-ray tube. It is attached to, and rotated by the operating ring and has a white cursor upon its outer face. The green tint permits patterns to be seen even when direct light falls on the screen. The fluorescent face of the 5-inch cathode-ray tube is also referred to as the "screen."

Cursor (15 of figure 4–1).—The cursor consists of four lines and an arrow etched on the screen. Three lines are parallel and one is perpendicular to the other three. In operation, the operating ring is rotated until the direction-finding pattern is symmetrical about the three parallel lines of the cursor. The perpendicular line is for bisecting the sense pattern to determine which half of the screen the sense shape occupies.

Arrow (17 of figure 4–1).—The arrow is etched on one end of the center of the three parallel lines of the cursor. When the pattern is symmetrical about the cursor and the arrow is in the correct half of the screen, the true bearing is read where the arrow points on the azimuth scale.

Azimuth scale (16 of figure 4–1).—The azimuth scale is marked in 2° intervals from 0° to 360° around the face of the cathode-ray tube.

LIGHTS (5 of figure 4–1).—Rotation of the LIGHTS control regulates the amount of illumination on the MEGACYCLES dial and the azimuth scale.

PHONES (19 of figure 4–1.—The phone jack is the receptacle for a standard single-circuit headset plug of the PL–55 type. The headset should be of 600-ohm impedance.

AUDIO GAIN (7 of figure 4–1).—Rotation of the AUDIO GAIN control will vary the headset volume but will not affect the patterns.

MEGACYCLES (9 of figure 4–1).—This dial is rotated by the tuning knob and indicates the frequency to which the equipment is tuned. The MEGACYCLES dial is calibrated in megacycle divisions from 100 mc to 156 mc.

LOCK (13 of figure 4–1).—Clockwise rotation of the LOCK control locks the tuning dial to prevent accidental adjustment.

b. PRESS-TO-ROTATE CONTROLS.—These five knobs must be pressed in to engage the controls which they operate. This safety factor is provided to prevent accidental adjustment of the controls. Under normal conditions, these five controls may be adjusted to provide for good direction-finding patterns, except that the VERT. and HORIZ. controls must not be adjusted while taking bearings. The following is a brief description of these press-to-rotate controls:

VERT. (1 of figure 4–1).—The vertical control moves the pattern (calibration or D/F) vertically across the screen, and should not be adjusted prior to consulting the calibration discussion of Section 4, paragraph 3.

FOCUS (2 of figure 4–1).—The sharpness of the pattern is controlled by this FOCUS control which may be adjusted whenever blurred patterns indicate the need.

BRILLIANCY (3 of figure 4–1).—This control may be adjusted at any time to obtain a bright pattern, *but the BRILLIANCY controls should never be placed in the maximum (fully clockwise) position.*

HORIZ. (4 of figure 4–1).—The horizontal control moves the pattern (calibration or D/F) horizontally across the screen, and should not be adjusted prior to consulting the calibration discussion of Section 4, paragraph 3.

CIRCLE DIA. (8 of figure 4–1).—The circle diameter control may be adjusted when the pattern does not touch the edge of the azimuth scale.

c. SCREWDRIVER CONTROLS.—*These controls are not operational controls and should never be adjusted unless absolutely necessary and only in accordance with the calibration adjustments described in Section 3, paragraph 6.* The need for adjustment of screwdriver controls may be determined by consulting the following calibration description of Section 4, paragraph 3. Because these screwdriver controls are not operational controls, no description of them will be given in this section.

3. CALIBRATION.

Calibration consists of adjustment of the various controls to provide that the various stages are properly matched. The more nearly they are matched, the more accurate will be the direction-finding information obtained. If the screwdriver controls are correctly adjusted, a correct calibration pattern may be obtained by adjustment of the VERT. (1 of figure 4–1), FOCUS (2 of figure 4–1), BRILLIANCY (3 of figure 4–1), HORIZ. (4 of figure 4–1), and CIRCLE DIA. (8 of figure 4–1) controls. It is desirable to periodically check the calibration pattern and, if not correct, to "touch up" the press-to-rotate controls. Every effort should be made to obtain the correct calibration pattern by means of these press-to-rotate controls, because adjustment of the screwdriver controls is difficult and should not be attempted unless absolutely necessary.

To obtain the calibration pattern, place the MOTOR ON-OFF and POWER ON-OFF switches in the ON positions, the CALIBRATE-SENSE switch in the CALIBRATE position, and adjust the R.F. SENS. control and tuning dial so that no signal is being received. A properly calibrated direction finder should produce a calibration pattern in which each of the 36 lobes are symmetrical, and in which no lobe deviates more than $\pm 1°$ from 10° intervals around the circle. For example, if the lobe near 0° points to 2°, the next lobe must be at 12° $\pm 1°$, the next at 22° $\pm 1°$, the next at 32° $\pm 1°$, and the next at 42° and so forth to 352° (see figure 4–2A). Adjustment of the VERT. control (1 of figure 4–1) will cause the pattern to move vertically across the screen (see figure 4–2B), and this control is adjusted until the 90° and 270° lobes have equal deviation. For example, if the 90° lobe is at 90° while the 270° lobe is at 274°, the VERT. control is adjusted until the 90° lobe is at 92° (90° + 2°) and the 270° lobe at 272° (270° + 2°). Adjustment of the HORIZ. control (4 of figure 4–1) will cause the pattern to move horizontally across the screen (see figure 4–2C), and this control is adjusted until the 0° and 180° lobes have equal deviation. For example, if the 0° lobe is at 4° while the 180° lobe is at 180°, the HORIZ. control is adjusted until the 0° lobe is at 2° (0° + 2°) and the 180° lobe is at 182° (180° + 2°). If adjustment of the HORIZ. and VERT. controls does not result in a pattern in which the 36 lobes are at 10° intervals around the azimuth scale (as in figure 4–2D), calibration adjustments must be made as is described in Section 3, paragraph 6.

4. DETAILED DESCRIPTION OF D/F PATTERNS.

a. UNMODULATED SIGNALS. — A strong, unmodulated r-f signal will produce a pattern in the shape of a propeller blade which will be symmetrical if the antenna elements have not been displaced with

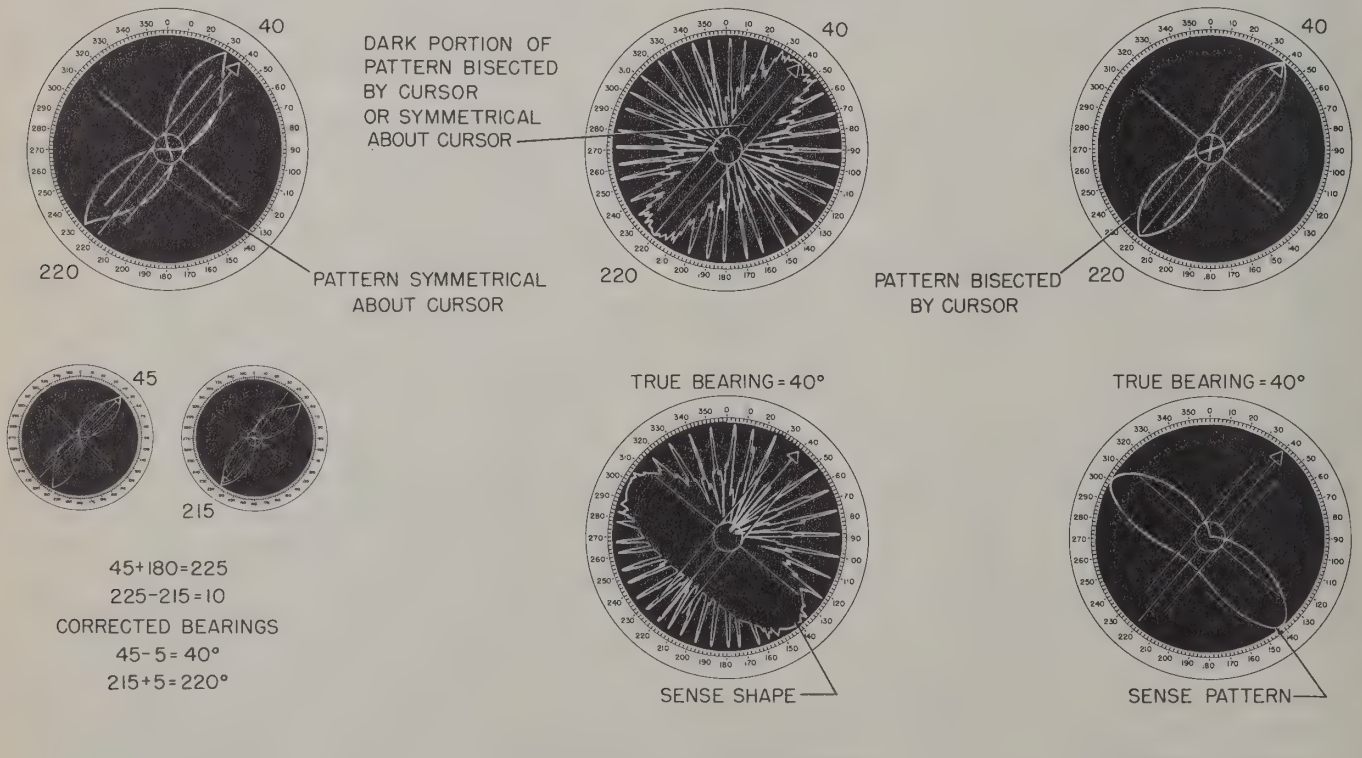


Figure 4–3. Methods of Reading Bearings

respect to each other and to the goniometer housing. Obtaining bearings with a symmetrical propeller-blade pattern consists of rotating the operating ring until the cursor bisects the propeller-blade pattern or until the pattern is symmetrical about the cursor (see figure 4–2F), and reading the bearing on the azimuth scale at the arrow (see figure 4–3C). If the antenna elements are slightly displaced, the propeller-blade pattern may be bent so that if the operating ring is rotated until the pattern is symmetrical about the cursor the ends of the center line of the cursor (that line having the arrow on one end) will not touch the tips of the pattern (see figure 4–2G). In other words, if the operating ring is rotated to position the arrow on one tip of the pattern, the opposite end of the cursor will not touch the other tip of the propeller-blade pattern (see figure 4–3A). With the bent propeller-blade pattern, the cursor may be rotated until the pattern is symmetrical about the cursor and the bearing read on the azimuth scale at the tip of the arrow. Or, the bearings may be read at the two tips of the pattern and the correct bearing determined by interpolation (see figure 4–3A). Instantaneous reception of more than one signal may cause inaccurate readings and may be recognized by a distorted pattern if the two signals are unmodulated, or may be recognized by the type of audio signal (squeals etc.) if the signals are modulated.

b. NOISE MODULATED SIGNALS.—Modulation of the r-f carrier will result in distortion of the propeller-shaped pattern. If the modulation is due to noise, the propeller-blade pattern distortion will be in the form of "grass." The degree to which this "grass" will distort the pattern will depend upon the amount of noise. This distortion due to noise should cause no trouble (see figure 4–2Q), and direction-finding information is obtained in the same way as with unmodulated signals.

c. TONE MODULATED SIGNALS.—In the case of tone modulated signals, the pattern will be a series of radial lines originating at the edge of the (now non-existing) propeller-blade pattern and radiating toward the edge of the screen (see figure 4–2R). The number of radial lines which make up the pattern will be dependent upon the audio frequency of the modulation, and the rate at which they rotate (if they do rotate) will depend upon the synchronization of the power supplies. Direction-finding information is obtained by utilization of the dark area of the pattern as though it were the pattern obtained with an unmodulated signal (see figure 4–3B). This "dark area" will probably be in the shape of the propeller blade or a bent propeller blade if the audio frequency of the modulation is sufficiently high or if the lines are rotating. If the pattern consists of only a few radial lines (low audio frequency modulation) which remain stationary, the pattern is utilized by optically drawing an imaginary line through the points at which the radial lines terminate prior to reaching the center of the screen, and using this imaginary propeller-blade shape in the manner described for unmodulated patterns. Usually it is necessary only to rotate the operating ring until the overall pattern is symmetrical about the cursor, with the three parallel lines of the cursor through the dark area, and then read the bearing where the arrow touches the scale.

d. VOICE MODULATED SIGNALS.—Voice modulation or frequency modulation may produce a pattern which may seem impossible to recognize as a "propeller-blade" pattern, when the operator is familiar with these types of patterns, however, there will be no trouble in obtaining direction-finding information. With 100 per cent voice modulation the resultant pattern will be somewhat that of a distorted tone-modulated pattern which is constantly changing shape as the voice changes in pitch, amplitude, and harmonic content (see figure 4–2T). Though the shape produced by voice modulation is constantly changing, the "propeller blade" or "bent propeller blade" shaped dark areas may be observed and used as described in the previous discussion of tone-modulated patterns. With frequency-modulated patterns and voice-modulated patterns which are not 100 per cent modulated, the radial lines will not reach the edge of the screen and the pattern will appear as a distorted propeller blade which is constantly changing shape. Study of the pattern should result in seeing the propeller shape either in the pattern itself or in the resultant dark area.

5. DETAILED DESCRIPTION OF SENSE PATTERNS.

a. UNMODULATED SIGNALS. — With an unmodulated r-f signal, the sense pattern will be a shape which may resemble a bent propeller, a peanut, or a cardiod depending upon the frequency and the strength of the signal. With a strong signal at the high frequency end of the dial, the sense pattern probably will resemble a bent propeller, and the sense of direction of the true bearing is obtained by rotating the operating ring to position the perpendicular line of the cursor (the line at right angles to the three parallel lines) so that the pattern will be symmetrical about this perpendicular line, and noting which side of this line contains the most pattern (see figure 4–2N). As the operating frequency becomes lower or as the signal is decreased, the bent propeller-shaped sense pattern approaches the shape of a peanut or double cardiod, and obtaining the sense of direction is simpler because it is necessary only to note in which half of the screen the pattern appears (see figure

4–2M). The true bearing will be in that half of the screen which contains no pattern when the sense switch (CALIBRATE-SENSE in SENSE position) is operated. This is obvious with the cardiod or kidney-shaped pattern obtained at the low frequency end of the dial with unmodulated r-f signals.

b. NOISE MODULATED SIGNALS.—Modulation of the r-f carrier results in the pattern distortion obtained when the signal is unmodulated. If the modulation is due to noise, the sense-pattern distortion will be in the form of "grass" on the pattern, and determination of the sense of direction is the same as with the unmodulated signals described in the previous paragraph (see figure 4–2Q).

c. TONE MODULATED SIGNALS.—In the case of tone modulated signals, the pattern probably will be a series of radial lines originating at the edges of the (now non-existent) sense pattern and radiating toward the edge of the screen. The diameter of the pattern, that is, the distance the radial lines travel toward the edge of the screen, is determined by the percentage of modulation. The number of radial lines is determined by the audio frequency of the modulation. These radial lines may remain stationary or may rotate depending upon the synchronization of the power supplies. The sense of direction is obtained by utilizing the dark area of this pattern as though it were the pattern obtained with an unmodulated signal (see figure 4–2R). This "dark area" probably will be in the shape of the previously described "bent propeller", "peanut", or "kidney" shapes if the audio frequency of the modulation is sufficiently high or if the lines are rotating. If the pattern consists of only a few radial lines which are stationary, observe the sense pattern and assume an imaginary line through the points at which the radial lines terminate prior to reaching the center of the screen. Use this imaginary shape in the manner described for unmodulated signal sense patterns.

d. VOICE MODULATED SIGNALS.—Voice modulation or frequency modulation may produce patterns which at first seem impossible to use. When familiar with these patterns, one should have no trouble in determining sense of direction. With 100 per cent voice modulation, the resultant pattern will be that of a distorted tone-modulated pattern which is constantly changing in pitch, amplitude, and harmonic content. Though the shape produced by voice modulation is constantly changing, the "bent propeller" and "peanut" shaped dark areas may be observed and used as described in the previous discussion of tone-modulated patterns. With frequency-modulated patterns and voice-modulated patterns which are not 100 per cent modulated, the radial lines will not reach the edge of the screen and the pattern will appear as a distorted sense pattern of constantly changing shape. Study of the pattern should result in observing the previously mentioned "bent propeller" or the "kidney" shapes either in the pattern or in the resultant dark areas, and the perpendicular line of the cursor may be utilized to determine which half of the screen contains this sense shape (see figures 4–2S and 4–2T).

SECTION 5
OPERATOR'S MAINTENANCE

WARNING

UNDER NO CIRCUMSTANCES SHOULD OPERATING PERSONNEL TAMPER WITH, OPEN, OR OTHERWISE DISTURB THE SHIELDED SECTION MARKED "DANGER 2000 VOLT CIRCUITS UNDER THIS SHIELD". Note, however, that dangerous potentials exist on portions of the equipment not within the shielded area, and caution should be exercised when working on this equipment with the dust cover removed.

1. CATHODE-RAY TUBE LIFE.

The life of the cathode-ray tube, V-127, (5CP1A) will be prolonged if the "BRILLIANCY" control (3 of figure 5–3) is left in some counterclockwise position. The image circle or pattern will burn the fluorescent coating of the cathode-ray tube if the "BRILLIANCY" control is left in maximum clockwise position for long lengths of time.

2. REPLACEMENT OF ELECTRON TUBES IN TYPE R–256A/URD–2 RADIO RECEIVER-INDICATOR.

If malfunctioning of the radio set seems to indicate tube failure, the tubes may be checked by removing the dust cover and following the procedure outlined in paragraphs 2*a* through 2*e*.

a. GAINING ACCESS TO THE ELECTRON TUBES.—Turn the "POWER" switch to "OFF" position before reaching within the set chassis or attempting to remove the chassis from the case. If there is not sufficient slack in the interconnecting cables to allow the receiver-indicator unit to be pulled forward, disconnect the three cable connectors from the rear of the unit. Remove the two thumbscrews which hold the dust cover to the front panel of the unit and pull the receiver-indicator chassis forward by its two handles. The tubes are now accessible.

Reconnect the cables as they were before removal of the chassis.

Remember to turn the power off before reaching into the set to remove or replace any of the tubes.

WARNING

OPERATING PERSONNEL SHOULD NOT REPLACE CATHODE-RAY TUBE V-127 (5CP1A) OR TUBE V-128 (1B3GT) BECAUSE OF DANGER FROM CONTACT WITH THE EXTREMELY HIGH VOLTAGES (2000V) USED IN THIS SECTION OF THE RECEIVER-INDICATOR.

b. DETERMINING TUBES WHICH NEED REPLACEMENT.—Tubes should be removed one at a time and tested in a tube tester such as Navy Model OZ series or equivalent. If no tube tester is available tubes may be checked by removing one tube at a time and replacing it with a tube known to be good. If the tube being checked appears good, it is good practice to use it in preference to a new tube because at the frequencies at which this equipment operates, a new tube sometimes necessitates readjustment of the circuit in which it is used. For the same reason, the removal of only one tube at a time eliminates the possibility of removing two tubes of the same type and of interchanging them when replacing them. Be sure that all tubes are securely seated in their sockets.

c. REMOVAL OF TUBES.—All electron tubes are identified in figure 5–1 and by circuit symbols stencilled on the chassis.

(1) To remove shields from tubes, turn shield as far counterclockwise as it will go and lift. The tube is now ready to be extracted.

(2) Do not remove tube V-128 (1B3GT) or cathode-ray tube V-127 (5CP1A) because of danger from contact with the extremely high voltages encountered in the circuits of these tubes.

d. REPLACEMENT OF ELECTRON TUBES.—All tubes of a given type supplied with the equipment shall be consumed prior to employment of tubes from general stock.

(1) MODULATOR TUBE AGING.—The modulator tubes (type 6AS6—V-117, V-118, V-119, and V-120) will change their electrical characteristics with use until about 24 hours of service. In order to keep a supply of these tubes on hand in case of tube failure in the receiver, it is well to have about a dozen 6AS6's aged and in stock.

Tubes may be aged as follows:

(a) Remove the four modulator tubes, marking

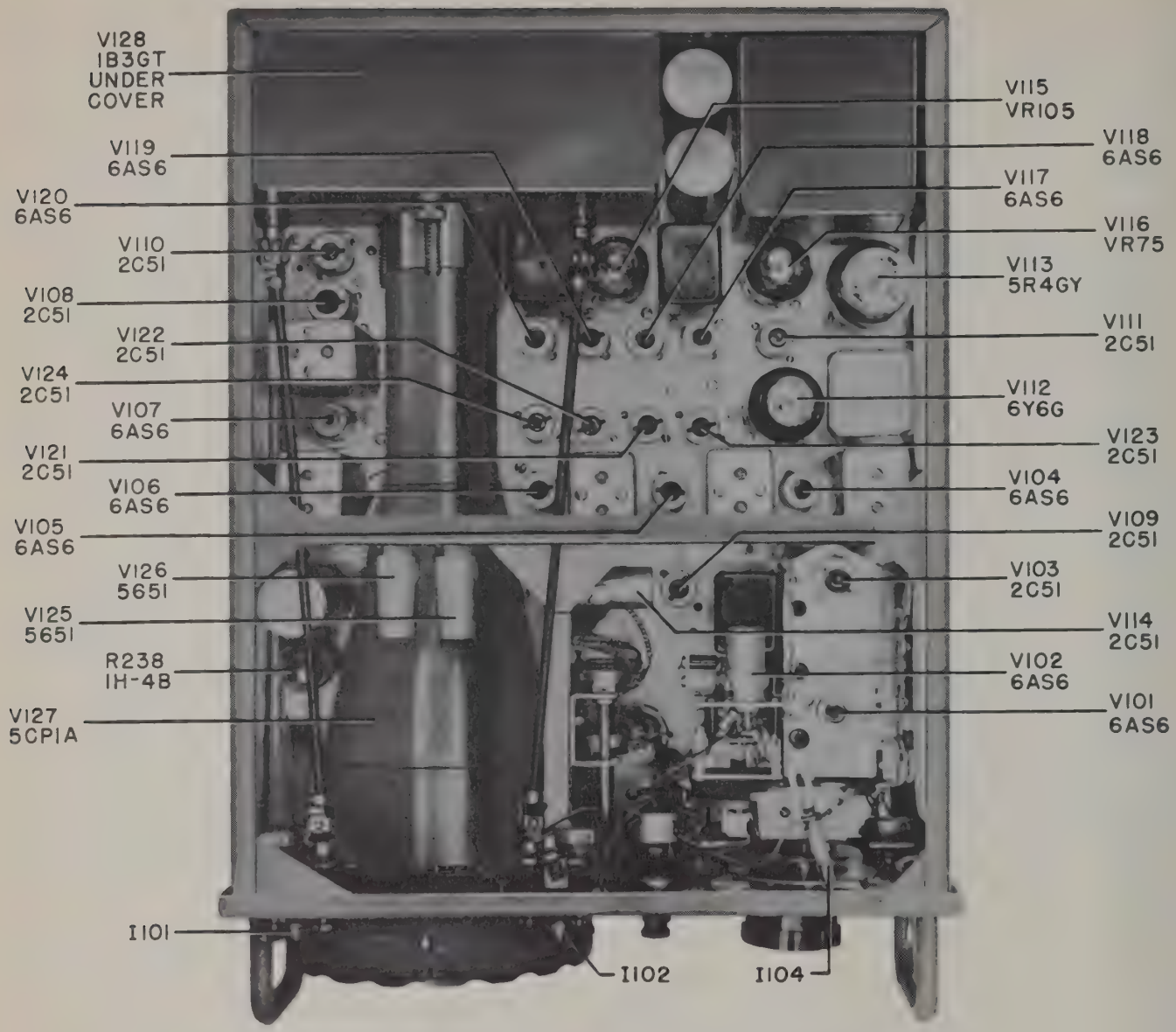


Figure 5–1. Type R–256A/URD–2 Radio Receiver-Indicator, Location of Electron Tubes and Lamps

each tube to ensure its replacement in the same socket from which it was removed.

(b) Insert four new tubes (shields are not necessary), and turn the receiver-indicator ON. DON'T MAKE ANY CALIBRATION-PATTERN ADJUSTMENTS WHILE THE NEW TUBES ARE AGING. The BRILLIANCY control should be fully counterclockwise during aging.

(c) Leave the tubes in the set for 24 hours, or for as long a time as possible until a 24-hour total time has been put on the tubes.

(d) Replace the original tubes in the same sockets from which they were removed.

(2) REPLACEMENT OF MODULATOR TUBES. —Whenever it becomes necessary to replace modulator tubes, perform steps *(a)* and *(b)*; then make any further adjustments necessary as per paragraph 2*c*(3) of this section.

(a) CALIBRATION-PATTERN SPOT CENTERING.

1 With the POWER switch ON and CALIBRATE-SENSE switch in neutral position, observe that a small spot of light appears on the screen somewhere near the center. If, after a reasonable warm-up period, this spot does not appear, rotate the BRILLIANCY control until the spot is visible.

CAUTION

TO PREVENT POSSIBLE DAMAGE TO THE CATHODE-RAY TUBE SCREEN DO NOT LEAVE THE "BRILLIANCY" CONTROL IN THE FULLY CLOCKWISE POSITION FOR MORE THAN A FEW SECONDS.

2 Turn on the MOTOR switch and use the FOCUS control to bring the resulting circle into sharp, clear focus. Too much brilliancy will cause distortion in lines, and the BRILLIANCY and FOCUS controls must be used together. Do not expect the figure to be a good circle at this stage.

3 Place the CALIBRATE-SENSE switch in the CALIBRATE position. The circular pattern will now be replaced by a 36-lobe "daisy" pattern. This is the calibration pattern the center point or spot of which should now be centered.

4 Note the very small etched ring in the center of the cursor screen and place the calibration spot in the exact center of the screen by positioning it within this ring. The screwdriver controls V.C. and H.C. are used to move the spot to the desired position. Parallax errors may be avoided by placing the reflected image of the eye used in sighting directly in the center of the screen as shown in figure 3–13. Accuracy in centering this spot will save trouble later.

(*b*) SETTING OF CIRCLE DIAMETER AND SHAPE.

1 Turn the motor OFF and place the CALIBRATE-SENSE switch in the neutral position. Center the spot now on the screen by using the HORIZ. and VERT. controls, in the same manner as the calibration spot was centered in *c.*(4).

2 Turn the motor on and observe figure on the screen. By means of the V.G. and H.G. screwdriver controls spread the figure to make it as circular as possible.

3 Adjust V.G. and H.G. further to bring the figure as near to the azimuth scale as possible. It may be necessary to use the CIRCLE DIA. control to achieve a circle which touches the scale, and this should be done rather than turning either gain control fully clockwise.

4 The figure now on the screen will probably be a circle distorted on one or both axes, an example of which condition is shown in figure 3–14. While this is a good possibility, distortion has other ramifications. Flats may appear on the periphery of the circle or elongations may be evident. The controls V.D. and H.D. are used to correct these conditions.

5 Flats may be eliminated by rotating the applicable control (V.D. for flats on top or bottom of circle and H.D. for flats on right or left of circle) until curvature results. Figure 3–14 demonstrates a particular instance of distortion, along with the proper corrective measure. A near-perfect circle may be impossible to attain, but this condition does not seriously affect the accuracy of D/F bearings.

Note

Since it is impossible to obtain a perfect circle, a good figure may be one which is slightly flat at each cardinal point (0°, 90°, 180°, 270°) and which has *equal radii* at these points. *If the circular figure has a flat on its periphery which causes the radius at that point to vary from the longest radius by as much as 1/8 of an inch, it is necessary to replace one of the modulator tubes. The characteristics of individual tubes vary, and each pair of modulators (horizontal pair and vertical pair) must be exactly balanced. This condition can be reached only by selecting tubes. Alignment procedure when tube selection is indicated is described in Section 7, paragraph 2a(3)b.*

e. ELECTRON TUBE REPLACEMENT WHICH NECESSITATES REALIGNMENT OF THE RECEIVER-INDICATOR.

(1) Replacement of the oscillator tube, V-102, may cause calibration of the tuning dial to be somewhat inaccurate; therefore, at the soonest possible date after replacement of this tube, have adjustment made by technical personnel as described in Section 7, paragraph 2*a*(2).

(2) For best operation after replacement of any tube in the r-f section—V-101, V-102, or V-103, the receiver should be aligned by technical personnel as described in Section 7, paragraph 2*a*(2).

(3) Replacement of any modulator tube will probably necessitate readjustment of the following controls:

(a) P.S.—Pattern Symmetry

(b) H.G. or V.G.—Horizontal or Vertical Gain

(c) VERTICAL and HORIZONTAL (Screwdriver—to be adjusted by technician).

(d) H.S. and V.S.—Horizontal and Vertical Symmetry

(e) H.D. and V.D.—Horizontal and Vertical Distortion.

Note

The function of each of the above controls is shown in figure 4–1, Section 4.

3. REPLACEMENT OF FUSE IN TYPE R–256A/URD–2 RECEIVER-INDICATOR.

The 3-ampere, 250-volt fuse, F101, is located on the rear of the receiver chassis to the right of the power receptacle. It is contained in a bakelite fuse-holder and is accessible without removing the dust cover from the chassis. To replace, unscrew the fuse-holder cap and withdraw it from the barrel. The fuse usually will be held within this cap upon its removal. Insert a new fuse of *equal rating* into the cap and replace in the barrel.

WARNING

Never replace a fuse with one of higher rating unless continued operation of the equipment is more important then probable damage. If the fuse burns out immediately after replacement, do not replace it a second time until the cause of the trouble has been corrected.

TABLE 5–1. ROUTINE CHECK CHART

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
Receiver R–256A/URD–2	With receiver on, place CAL-D/F-SENSE switch in CAL position; R.F. SENS and AUDIO GAIN controls in full clockwise position; plug in headset.	Background noise should be evident in headset. Do not leave controls in full clockwise position for longer time than necessary to make check.
Indicator section	With receiver on, place CAL-D/F-SENSE switch in CAL position.	Calibration (36-lobe) pattern should appear; spokes should be approximately equal.
Rotation of antenna goniometer	With receiver turned on, place MOTOR switch in ON position. Observe pattern on cathode-ray tube.	Pattern must be circular. This indicates motor and alternator are O.K.

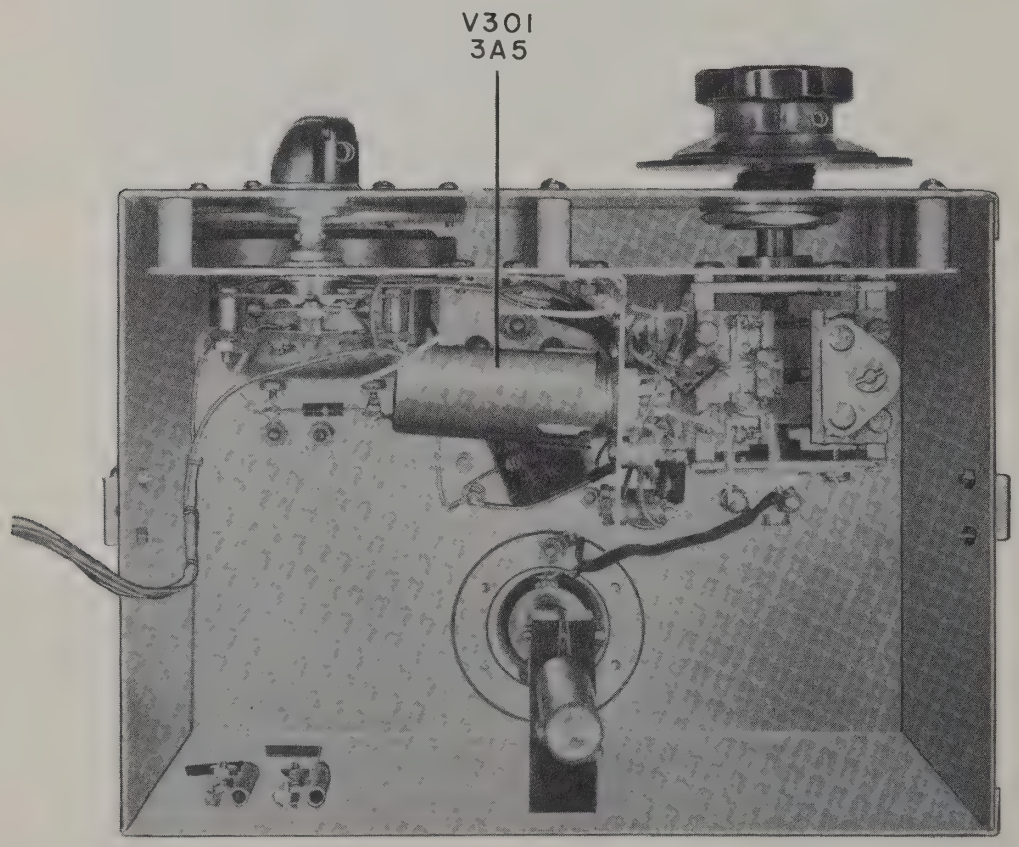


Figure 5–2. Type T–207A/URD–2 Target Transmitter, Location of Tube

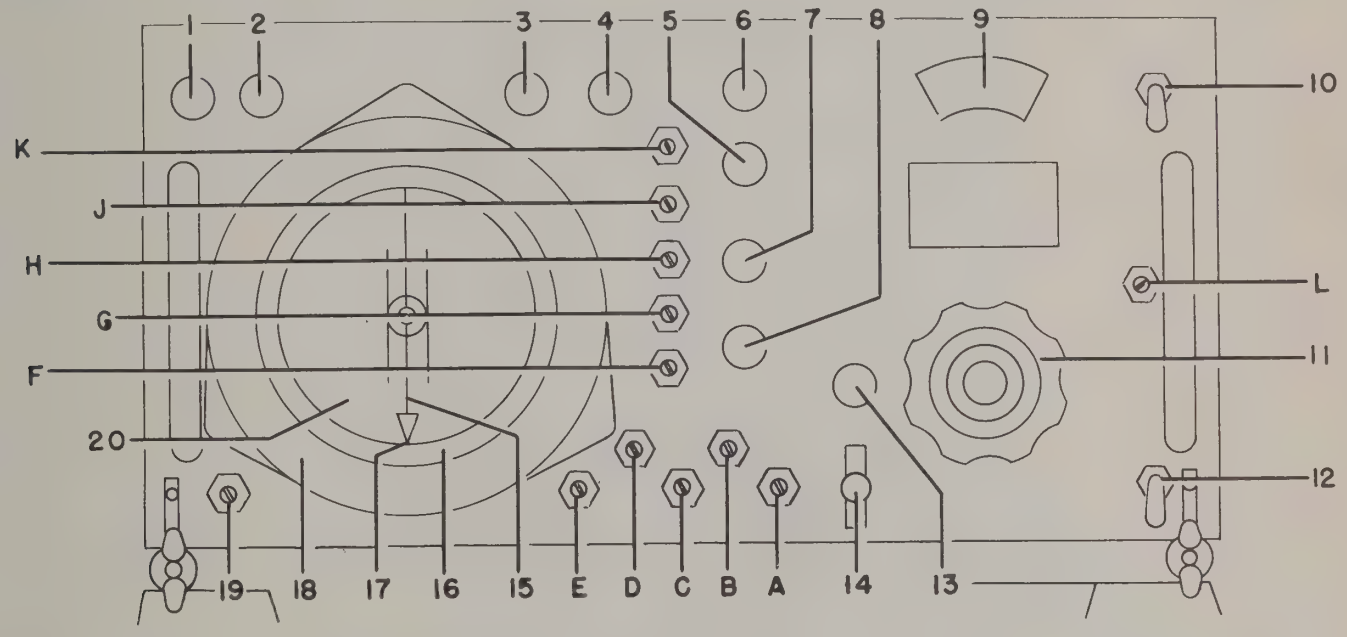
4. REPLACEMENT OF DIAL LAMPS IN TYPE R–256A/URD–2 RECEIVER-INDICATOR.

a. AZIMUTH SCALE LAMPS.—I-101, I-102, and I-103 are 6-volt, 0.2-ampere lamps which illuminate the azimuth scale and are accessible on the periphery of the alidade housing assembly on the front panel. Each lamp is attached to a small black knob which is unscrewed from the alidade housing to replace the lamp assembly. See figure 5–1 for locations.

b. TUNING DIAL LAMP. — Bayonet base lamp I-104, a 6-3-volt, 0.15-ampere lamp is used to illuminate the tuning dial. To remove or replace it, the chassis must be partly removed from the dust cover. See figure 5–1 for location.

5. REPLACEMENT OF ELECTRON TUBE IN TYPE T–207A/URD–2 TRANSMITTER.

a. GAINING ACCESS TO ELECTRON TUBE.—Open the two snap clamps on each side of the transmitter case and separate the upper and lower sections of the transmitter. A short cable connects the upper section to the batteries in the lower section, but the two halves may be separated enough to see if the electron tube is lighted without disconnecting this cable. The tube will be found lying crosswise in the case to the side of the tuning capacitor (see figure 5–2). To observe illumination of the tube, it is necessary to remove the tube shield. This is done by depressing the shield, twisting counterclockwise, and lifting the shield off. Replacement of the tube does not necessitate any realignment of the target transmitter.



1 VERTical
2 FOCUS
3 BRILLIANCY
4 HORIZontal
5 LIGHTS
6 R.F. SENSitivity
7 AUDIO GAIN
8 CIRCLE DIAmeter
9 MEGACYCLES
10 MOTOR ON-OFF
11 Tuning dial
12 POWER ON-OFF
13 LOCK
14 CALIBRATE-SENSE
15 Cursor
16 Azimuth scale
17 Arrow
18 Operating ring
19 PHONES
20 Screen
A V.G. (vert. gain)
B H.D. (distortion)
C PH. (phase)
D V.D. (distortion)
E H.G. (hor. gain)
F H.S. (symmetry)
G H.C. (center)
H P.S. (pat. sym.)
J V.C. (center)
K V.S. (symmetry)
L CAL.

Figure 5–3. Radio Receiver R–256A/URD–2, Front Panel Controls

SECTION 6

PREVENTIVE MAINTENANCE

TABLE 6–1
ROUTINE MAINTENANCE CHECKS

THE ATTENTION OF MAINTENANCE PERSONNEL IS INVITED TO THE REQUIREMENTS OF CHAPTER 67 OF THE *BUREAU OF SHIPS MANUAL,* OF THE LATEST ISSUE.

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
1. Calibration accuracy	*a.* Check hourly. *b.* With equipment operating, place CAL-SENSE switch on "CALIBRATE" position. The 36-lobe pattern will appear on the CR screen. Now check alignment at the 0°, 90°, 180° and 270° points. A pair of opposite lobes (one at 0° and one at 180°) must have the same amount of deviation, viz: 3° and 183°. Thus the pair at 90° and 270° should show the same amount of deviation in the same direction (93° and 273°). If the deviations of the 0°-180° pair are not equal, depress and rotate the HORIZontal control on the panel until they are equalized. If the deviations of the 90°-270° pair are not equal, depress and rotate the VERTical control on the panel until they are equalized. *c.* The VERTical and HORIZontal controls will affect each other, so that adjustment of one probably will require adjustment of the other, until the proper settings are reached. The deviation at 0° and 180° should not be different from that at 90° and 270° by more than 1°. Deviation from the cardinal points (0°, 90°, 180° and 270°) themselves is immaterial.	Be sure that, after performing any necessary adjustments to HORIZ. and VERT., the 10° difference between lobes is accurate. This interval should be held to ±2°. If it is not, have indicator readjusted by technical personnel. The R-F SENS. control must be at minimum throughout calibration check.
2. Condition of target transmitter batteries	*a.* Check weekly. *b.* Turn transmitter on and note that the meter swings to indicate oscillation. If it does not, inspect the tube by separating the two parts of the transmitter and seeing if the tube filaments are lighted. Replace battery BA–65 if the filaments are not lighted, and, if no lighting is obtained after this, place in hands of technician. *c.* Upon finding tube filament batteries in operating condition and with no meter indication, replace batteries BA–63 with fresh batteries. *d.* Further faulty operation of the transmitter should be assigned to some cause other than the batteries and the unit turned over to a technician.	If transmitter is still inoperative after fresh batteries have been installed, remove *all* batteries until trouble has been corrected by a technician.
3. Electrical components	*a.* Check monthly. *b.* Check parts for overheating by noting temperature after the equipment has been operating for an extended length of time. This could include parts such as the power transformers, T–101 and T–102, and the antenna goniometer motor, if accessible.	Turn the main power switch OFF before removing dust cover to inspect parts.

TABLE 6–1
ROUTINE MAINTENANCE CHECKS (Cont.)

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
4. Receiver sensitivity	*a.* Check monthly. *b.* Disconnect the antenna coaxial cable from the receiver-indicator. Connect a signal generator having a 52Ω output impedance to the receiver input coaxial fitting. *c.* Connect a voltmeter having an a-c sensitivity of at least 1000 ohms-per-volt across terminals 3 and 4 of the receiver audio output transformer, Z–106A, with the R-F SENS control at maximum, and tune signal generator and receiver to 130 mc. *d.* Feed in the signal to give 10 volts output with 30% modulation on the carrier. This output may be obtained by adjustment of either the audio gain of the receiver or the signal generator output. *e.* Turn off modulation and note noise output on meter. *f.* If noise is less than 1 volt, lower signal generator output until noise reaches 1 volt. If noise is greater than 1 volt, raise signal generator output until noise reaches 1 volt. *g.* Turn on modulation and adjust audio gain until level of 10 volts is reached. *h.* Cut modulation and check noise again. *i.* Repeat steps *e.* to *h.* until the noise is 1 volt (modulation off) for a signal of 10 volts (modulation on). *j.* When this condition has been satisfied, the output of the signal generator (as indicated by the output level dial or attenuator on the signal generator) *is* the sensitivity of the receiver. *k.* If the sensitivity of the receiver is *more* than 20 microvolts, the receiver is in need of servicing, probably realignment, and should be realigned or otherwise repaired until at least the specified sensitivity (20 μv at a signal-to-noise ratio of 10:1) is attained.	Be sure that there is a good ground connection between the signal generator and the receiver. Keep the length of leads from the signal generator to the receiver less than one inch, unless provision is made on the signal generator for connecting its output to the receiver input by means of 52Ω coaxial cable. This check should be run only by a qualified technician.
5. Electron tubes	*a.* Check every two months. *b.* Remove chassis from dust cover and check the tubes in a tube checker every two months or every thousand hours of operation, whichever occurs sooner.	Remove, check, and replace one tube at a time to prevent confusion of tubes.
6. Electrical components	*a.* Check quarterly. *b.* Remove chassis from dust cover and inspect parts for signs of blistering, bulging, or discoloration indicative of overheating. Also look for leakage of insulating compounds, corrosion, and fungus.	Turn power off.
7. Unit wiring	*a.* Check along with electrical component check. *b.* Look for loose or broken connections or obvious short circuits. Inspections should be mainly visual; however, faulty connections may frequently be located by tapping with a piece of insulating material while receiver is turned on and adjusted for normal operation.	Use caution when probing connections with the set turned on, since high voltages occur at many points in the circuit. Connections of stranded wire should be replaced if one-third or more of the strands are broken.
8. Mounting of components	*a.* Check quarterly. *b.* Check all parts for rigidity of mounting. See that all nuts and bolts are drawn up to their proper tightness, and that other mounting hardware is in place and fastened securely.	

1. LUBRICATION DATA.

Periodic lubrication of Model AN/URD–2A Radio Direction Finding Equipment is not required. The bearings in the goniometer are sealed ball bearings and need not be lubricated. The only other moving parts are the alidade ring and the receiver tuning capacitor drive assembly.

a. ALIDADE OPERATING RING.—The alidade assembly is that housing which surrounds the azimuth scale. Rollers and roller screws of the alidade ring and assembly were lubricated at the factory. If, for any reason, this must be disassembled, it may be relubricated with specification MIL–G–3278 (formerly AN–G–25) grease. Otherwise these points should not require relubrication because the operating ring is not continuously rotating.

b. RECEIVER TUNING CAPACITOR DRIVE ASSEMBLY.—Gears, bearings, and tuning shaft coupling of the tuning capacitor drive assembly were lubricated at the factory, and should not require supplementary lubrication unless disassembled. Use specification MIL–G–3278 grease for this purpose.

c. The Aviation Supply Office Stock Numbers for specification MIL–G–3278 grease are as follows:

Standard Navy Stock Number	*Size of Container*
R14–G–984–500	8 oz. tube
R14–G–982–20	1 lb. can
R14–G–984–520	5 lb. can

SECTION 7
CORRECTIVE MAINTENANCE

1. THEORY OF LOCALIZATION OF TROUBLE.

Since the Receiver-Indicator R–256A/URD–2 has both audio and video outputs, the location and nature of trouble may be quickly and accurately assigned if the proper procedure is followed. By systematic testing and elimination of one major unit at a time, the faulty unit may ultimately be located.

Occasionally, breakdowns or improper adjustments in one section will cause improper operation of following or associated stages, and the whole unit should be retested after replacing or adjusting any part thereof.

A method of localizing and diagnosing trouble is outlined in the Trouble Shooting Chart, Table 7–1. While this does not cover all possible causes of trouble, it will be found helpful as a general trouble-location procedure.

2. CORRECTIVE MEASURES.

a. ELECTRICAL REPAIR AND ADJUSTMENT.

(1) I-F ALIGNMENT OF RECEIVER.

(a) NORMAL ALIGNMENT PROCEDURE.

1. Connect a voltmeter (of at least 1000Ω/volt a-c resistance) in series with a 0.25 uf capacitor across the AUDIO jack on the receiver front panel.

2. Inductively couple a signal generator to the mixer grid coil (L103) (figure 7–6) by interwinding about two turns of insulated wire in this coil and connecting the ends to the signal generator.

3. Turn the R-F SENS and AUDIO GAIN controls fully clockwise.

4. Set the signal generator to 12 mc, modulated at 30 per cent with 400 cps audio, and raise its output until the meter across the audio jack terminals gives some substantial reading.

5. Detune the secondary of Z102 (2nd i-f transformer) by turning the slug counterclockwise until it is approximately 1/2 inch out of the can. (See figure 7–2 for locations of i-f and r-f adjustments.)

6. Tune the primary of Z102 for a peak and follow by peaking the secondary.

7. Tune the third i-f transformer, Z103, as in *5* and *6*, keeping the signal generator output low enough to prevent the receiver output from exceeding 7 volts.

8. Set the signal generator frequency at 11.98 mc.

9. Repeat steps *5* and *6* for Z101 (1st i-f transformer).

10. Repeat steps *5* and *6* for Z104 (4th i-f transformer).

11. Set the signal generator frequency at 11.96 mc.

12. Repeat steps *5* and *6* for Z105 (5th i-f transformer).

(b) ALIGNMENT PROCEDURE WHEN I-F CIRCUITS ARE COMPLETELY DETUNED.—Frequently the i-f transformers may be so badly misaligned that it is impossible to see any indication on the output meter when a signal is fed into the mixer coil. In such an event use the following procedure:

1. Set the signal generator to *12 mc* and connect a 0.01 uf capacitor in series with the "hot" lead.

2. Keeping leads to minimum length, connect the output to the grid (pin #1) of V107.

3. Adjust the output of the signal generator to give an output of less than 7 volts.

4. Detune the secondary of Z107 (figure 7–3) and peak the primary for maximum output.

5. Tune the secondary of Z107.

6. Tune each preceding stage (V106 and Z104, V105 and Z103, and V104 and Z102) as in steps *2, 3, 4,* and *5.*

7. Proceed with normal alignment as in (a), steps *1* to *12.*

(2) R-F ALIGNMENT OF RECEIVER.

(a) TUNING DIAL ALIGNMENT.—Before proceeding with the electrical alignment of the receiver r-f circuits, be sure that the dial is in alignment with the tuning capacitor gangs. To test this alignment turn the tuning knob clockwise and watch for the word ALIGN to appear at the index line. When the ALIGN mark and the index line coincide, the capacitor rotor and stator plates should exactly mesh. If they do not, the following procedure may be used to align the dial:

1. Remove nameplate.

2. Rotate tuning control from one end of

FAILURE REPORTS

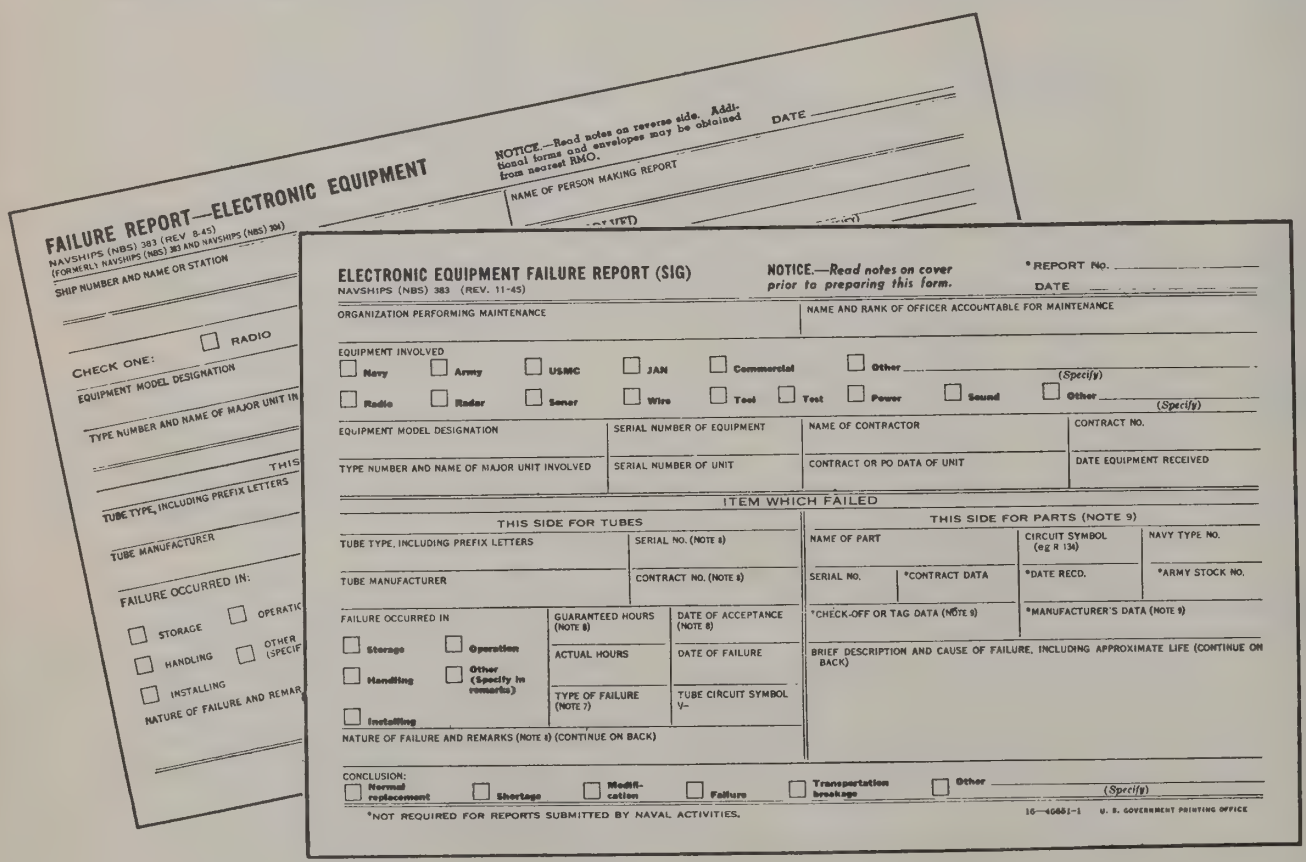
A FAILURE REPORT must be filled out for the failure of any part of the equipment whether caused by defective or worn parts, improper operation, or external influences. It should be made on Failure Report, form NBS-383, which has been designed to simplify this requirement. The card must be filled out and forwarded to BUSHIPS in the franked envelope which is provided. Full instructions are to be found on each card.

Use great care in filling the card out to make certain it carries adequate information. For example, under "Circuit Symbol" use the proper circuit identification taken from the schematic drawings, such as T-803, in the case of a transformer, or R-207, for a resistor. Do not substitute brevity for clarity. Use the back of the card to completely describe the cause of failure and attach an extra piece of paper if necessary.

The purpose of this report is to inform BUSHIPS of the cause and rate of failures. The information is used by the Bureau in the design of future equipment and in the maintenance of adequate supplies to keep the present equipment going. The cards you send in, together with those from hundreds of other ships, furnish a store of information permitting the Bureau to keep in touch with the performance of the equipment of your ship and all other ships of the Navy.

This report is not a requisition. You must request the replacement of parts through your Officer-in-Charge in the usual manner.

Make certain you have a supply of Failure Report cards and envelopes on board. They may be obtained from any Electronics Officer.



FAILURE REPORT—ELECTRONIC EQUIPMENT
NAVSHIPS (NBS) 383 (REV. 8-45)
(FORMERLY NAVSHIPS (NBS) 383 AND NAVSHIPS (NBS) 384)
SHIP NUMBER AND NAME OR STATION
CHECK ONE: RADIO
EQUIPMENT MODEL DESIGNATION
TYPE NUMBER AND NAME OF MAJOR UNIT IN
THIS
TUBE TYPE, INCLUDING PREFIX LETTERS
TUBE MANUFACTURER
FAILURE OCCURRED IN:
STORAGE OPERATIC
HANDLING OTHER (SPECIF
INSTALLING
NATURE OF FAILURE AND REMAR
NOTICE.—Read notes on reverse side. Additional forms and envelopes may be obtained from nearest RMO.
DATE
NAME OF PERSON MAKING REPORT

ELECTRONIC EQUIPMENT FAILURE REPORT (SIG)
NAVSHIPS (NBS) 383 (REV. 11-45)
NOTICE.—Read notes on cover prior to preparing this form.
*REPORT No.
DATE
ORGANIZATION PERFORMING MAINTENANCE
NAME AND RANK OF OFFICER ACCOUNTABLE FOR MAINTENANCE
EQUIPMENT INVOLVED
Navy Army USMC JAN Commercial Other (Specify)
Radio Radar Sonar Wire Test Test Power Sound Other (Specify)
EQUIPMENT MODEL DESIGNATION | SERIAL NUMBER OF EQUIPMENT | NAME OF CONTRACTOR | CONTRACT NO.
TYPE NUMBER AND NAME OF MAJOR UNIT INVOLVED | SERIAL NUMBER OF UNIT | CONTRACT OR PO DATA OF UNIT | DATE EQUIPMENT RECEIVED
ITEM WHICH FAILED
THIS SIDE FOR TUBES
TUBE TYPE, INCLUDING PREFIX LETTERS | SERIAL NO. (NOTE 8)
TUBE MANUFACTURER | CONTRACT NO. (NOTE 8)
FAILURE OCCURRED IN
Storage Operation Handling Other (Specify in remarks) Installing
GUARANTEED HOURS (NOTE 8) | DATE OF ACCEPTANCE (NOTE 8)
ACTUAL HOURS | DATE OF FAILURE
TYPE OF FAILURE (NOTE 7) | TUBE CIRCUIT SYMBOL V–
NATURE OF FAILURE AND REMARKS (NOTE 8) (CONTINUE ON BACK)
THIS SIDE FOR PARTS (NOTE 9)
NAME OF PART | CIRCUIT SYMBOL (eg R 134) | NAVY TYPE NO.
SERIAL NO. | *CONTRACT DATA | *DATE RECD. | *ARMY STOCK NO.
*CHECK-OFF OR TAG DATA (NOTE 9) | *MANUFACTURER'S DATA (NOTE 9)
BRIEF DESCRIPTION AND CAUSE OF FAILURE, INCLUDING APPROXIMATE LIFE (CONTINUE ON BACK)
CONCLUSION:
Normal replacement Shortage Modification Failure Transportation breakage Other (Specify)
*NOT REQUIRED FOR REPORTS SUBMITTED BY NAVAL ACTIVITIES.
16—40681-1 U. S. GOVERNMENT PRINTING OFFICE

Figure 7–1. Failure Report, Sample Form

pots R222 and R225
be centered
Motor B401
Starting Capacitor Winding
Power leads
Generator G401
Power leads
Winding Defective S101
Spot on CRT Face, can be centered
Place motor switch in ON position
No Circle on CRT
Pattern broken line with pips, pulled to one side or top or bottom of CRT
Half of V123 or V124 inoperative
Circle OK
Place CAL switch in CAL position
No 36-Lobe Pattern
Pattern distorted, pulled to one side or top or bottom of CRT
Defective E445 tone generator, discontinuity in leads. Defective modulators V117, V118, V119, V120
Defective Modulator (V117, V118, V119, V120) or Amplifier (V123, V124)
36-Lobe Pattern OK
Turn R-F SENS to max. Tune receiver to A.M. r-f signal, plug headset into front panel jack, and place CAL-SENSE switch in Center (D-F) position
No Audio or propeller pattern
No Audio
No propeller pattern
Ground or open in leads to ant. elements, goniometer capacitors, or bazooka; or in these units themselves, no signal from R-F of I-F sections. (See Sect. 7 para 2a.(2) for R-F alignment; Sect. 7 para 2a.(1) for I-F alignment) V108
V109, Z106A
CAL-SENSE switch S101, V110, V114
Audio and Propeller Pattern OK
Place CAL-SENSE switch in SENSE position
Propeller pattern rotates 90°, does not lose blade
K401 does not close. Sense ant grounded. Primary of L401 shorted, S101
Pattern folds back, blade disappears
Direction Finder operates satisfactorily

TABLE 7-1. TROUBLE SHOOTING CHART

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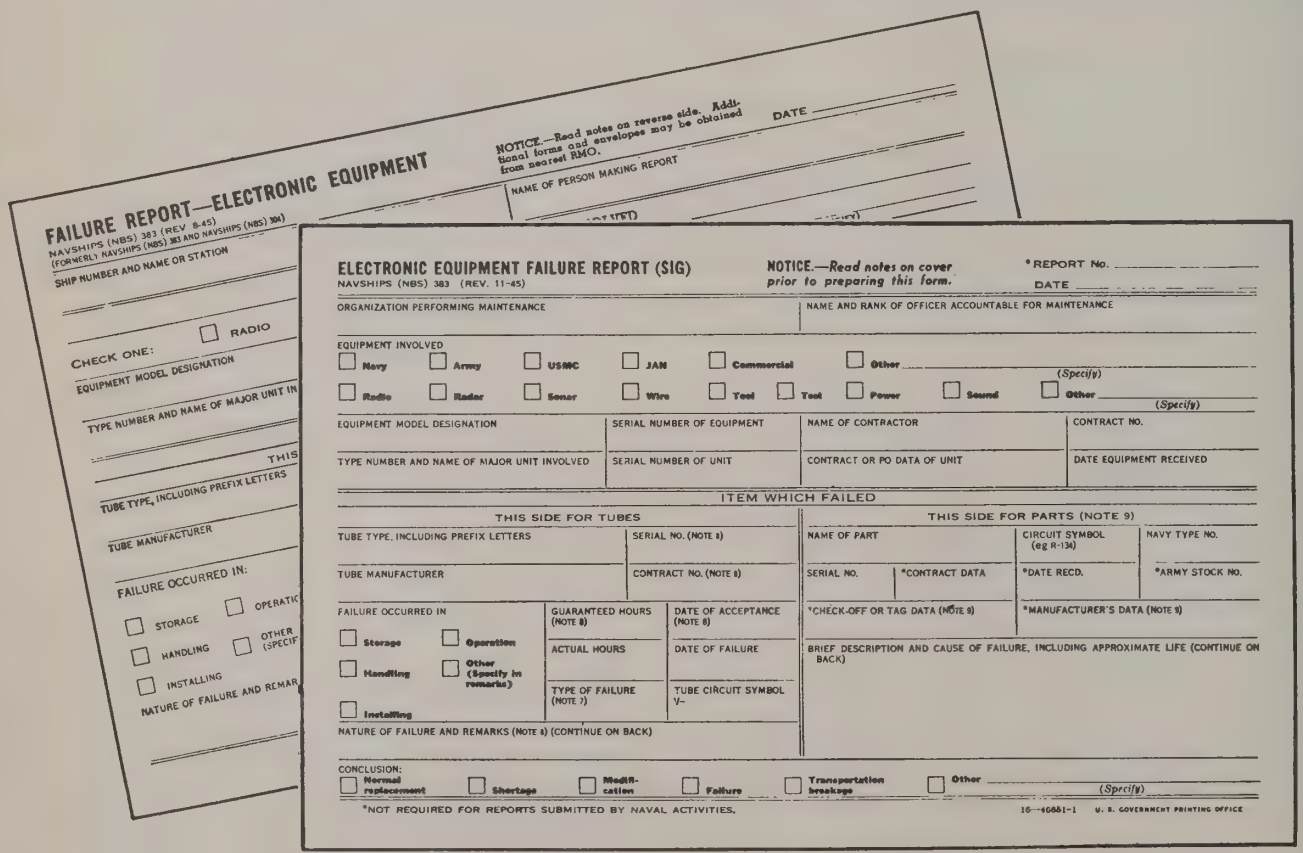


FAILURE REPORT—ELECTRONIC EQUIPMENT
NAVSHIPS (NBS) 383 (REV 8-45)
(FORMERLY NAVSHIPS (NBS) 383 AND NAVSHIPS (NBS) 384)
SHIP NUMBER AND NAME OR STATION
CHECK ONE: RADIO
EQUIPMENT MODEL DESIGNATION
TYPE NUMBER AND NAME OF MAJOR UNIT IN
TUBE TYPE, INCLUDING PREFIX LETTERS
TUBE MANUFACTURER
FAILURE OCCURRED IN:
STORAGE
HANDLING
INSTALLING
NATURE OF FAILURE AND REMAR
NOTICE.—Read notes on reverse side. Additional forms and envelopes may be obtained from nearest RMO.
DATE
NAME OF PERSON MAKING REPORT

ELECTRONIC EQUIPMENT FAILURE REPORT (SIG)
NAVSHIPS (NBS) 383 (REV. 11-45)
NOTICE.—*Read notes on cover prior to preparing this form.*
*REPORT No.
DATE
ORGANIZATION PERFORMING MAINTENANCE
NAME AND RANK OF OFFICER ACCOUNTABLE FOR MAINTENANCE
EQUIPMENT INVOLVED
Navy Army USMC JAN Commercial Other (Specify)
Radio Radar Sonar Wire Test Test Power Sound Other (Specify)
EQUIPMENT MODEL DESIGNATION
SERIAL NUMBER OF EQUIPMENT
NAME OF CONTRACTOR
CONTRACT NO.
TYPE NUMBER AND NAME OF MAJOR UNIT INVOLVED
SERIAL NUMBER OF UNIT
CONTRACT OR PO DATA OF UNIT
DATE EQUIPMENT RECEIVED
ITEM WHICH FAILED
THIS SIDE FOR TUBES
TUBE TYPE, INCLUDING PREFIX LETTERS
SERIAL NO. (NOTE 8)
TUBE MANUFACTURER
CONTRACT NO. (NOTE 8)
FAILURE OCCURRED IN
Storage Operation
Handling Other (Specify in remarks)
Installing
GUARANTEED HOURS (NOTE 8)
DATE OF ACCEPTANCE (NOTE 8)
ACTUAL HOURS
DATE OF FAILURE
TYPE OF FAILURE (NOTE 7)
TUBE CIRCUIT SYMBOL
NATURE OF FAILURE AND REMARKS (NOTE 6) (CONTINUE ON BACK)
THIS SIDE FOR PARTS (NOTE 9)
NAME OF PART
CIRCUIT SYMBOL (eg R-134)
NAVY TYPE NO.
SERIAL NO.
*CONTRACT DATA
*DATE RECD.
*ARMY STOCK NO.
*CHECK-OFF OR TAG DATA (NOTE 9)
*MANUFACTURER'S DATA (NOTE 9)
BRIEF DESCRIPTION AND CAUSE OF FAILURE, INCLUDING APPROXIMATE LIFE (CONTINUE ON BACK)
CONCLUSION:
Normal replacement Shortage Modification Failure Transportation breakage Other (Specify)
*NOT REQUIRED FOR REPORTS SUBMITTED BY NAVAL ACTIVITIES.
16—40881-1 U. S. GOVERNMENT PRINTING OFFICE

Figure 7–1. Failure Report, Sample Form

TABLE 7-1. TROUBLE SHOOTING CHART

CHECK		POSSIBLE CAUSES OF TROUBLE
Turn power switch ON and observe illumination of pilot lamps	Pilot Lamps Do Not Light	Fuse F101, "LIGHTS" control R167, Power Switch S102, pri winding of T101 (term 1 & 2), 3 v winding of T101 (term 8 & 9), loss of continuity between between P106-P103 and J103.
Lamps OK		
Check Tubes for lighting		
V101-3-4-5-6-7-8-9-10-11-14-17-18-19-20-21	Do Not Light	Tubes, fil. winding of T101 between terminals 8 and 10
V123, V124	Do Not Light	Tubes, fil. winding of T101 between terminals 14 and 15
V112, V122	Do Not Light	Tubes, fil. winding of T101 between terminals 12 and 13
R238 (1H-48) or V102	Do Not Light	Tubes, fil. winding of T101 between terminals 8 and 11
V128	Does Not Light	Tube, pri (term 1 and 2) and fil. (term 3 and 4) windings of T102 Safety Switch S104
V113	Does Not Light	Tube, fil. winding of T101 between terminals 3 and 4
V127	Filament does not light	Tube, fil. winding of T102 between terminals 5 and 6
Tubes Light		
Place motor switch in OFF position, cal. switch in center BRILLIANCY control full on, R-F SENS. counterclockwise	No Spot on CRT Face	CRT, V128, BRILLIANCY pot R230, hi-voltage winding of T102 (term 7 & 8) H-V dropping and bleeder resistors, FOCUS pot R228
	Spot appears but cannot be centered	V123, V124, or associated components, centering pots R222 and R225
Spot on CRT Face, can be centered		
Place motor switch in ON position	No Circle on CRT	Motor B401: Starting Capacitor, Winding, Power leads Generator G401: Power leads, Winding, Defective S101
	Pattern broken line with pips, pulled to one side or top or bottom of CRT	Half of V123 or V124 inoperative
Circle OK		
Place CAL switch in CAL position	No 36-Lobe Pattern	Defective E445 tone generator, discontinuity in leads. Defective modulators V117, V118, V119, V120
	Pattern distorted, pulled to one side or top or bottom of CRT	Defective Modulator (V117, V118, V119, V120) or Amplifier (V123, V124)
36-Lobe Pattern OK		
Turn R-F SENS to max, Tune receiver to A.M. r-f signal, plug headset into front panel jack, and place CAL-SENSE switch in Center (D-F) position	No Audio or propeller pattern	Ground or open in leads to ant. elements, goniometer capacitors, or bazooka; or in these units themselves, no signal from R-F of I-F sections. (See Sect. 7 para 2a.(2) for R-F alignment; Sect. 7 para 2a.(1) for I-F alignment) V108
	No Audio	V109, Z106A
	No propeller pattern	CAL-SENSE switch S101, V110, V114
Audio and Propeller Pattern OK		
Place CAL-SENSE switch in SENSE position	Propeller pattern rotates 90°, does not lose blade	K401 does not close. Sense ant grounded. Primary of L401 shorted, S101
Pattern folds back, blade disappears		
Direction Finder operates satisfactorily		

dial to the other while watching through the hole under the nameplate. As the three screws (at aproximately 100 mc, 120 mc, and 143 mc, on the dial) appear, loosen them.

3. Carefully mesh tuning capacitor plates and rotate tuning knob until the ALIGN mark is at the index line of the dial window. Do not let the capacitor rotor plates rotate while the ALIGN mark is being set.

4. With the plates fully meshed and the ALIGN mark positioned properly, tighten the screw which is accessible through the hole under the nameplate.

5. Rotate the tuning knob to make the remaining two screws accessible, tighten these, and check.

6. Replace nameplate.

(b) R-F CIRCUIT ALIGNMENT.

1. Connect the output of a UHF Signal Generator Equipment, Navy Model LX (Series), or equivalent through its output cable and attenuator to the antenna connector, located on the rear of the receiver-indicator. Keep the cable between the attenuator and J101 as short as possible.

2. Set the input signal to 140 mc with 30 per cent modulation, 400 cps, and at a high level (about 0.1 volt).

3. Turn the AUDIO gain and R-F SENS. controls to fully clockwise position and turn the receiver dial to 140 mc.

4. Adjust the oscillator trimmer capacitor, C111A, for peak output.

5. Adjust trimmers C101B, C101C, and C101F in that order (see figure 7–2 for location), for peak output, keeping the output below 7 volts by controlling the signal generator output.

6. Set the signal generator and receiver dial to 110 mc and adjust the slug of L104 for a peak.

7. Adjust the r-f coils L101, L102, and L103 (see figure 7–6 for location) for peak output by squeezing or spreading the coils. This is best accomplished by using insulated non-metallic tools to work on the coils. Always keep the hands as far from the work as possible because hand capacity will cause errors even when using non-metallic tools, at frequencies of this order.

8. Adjust the coupling between L102 and L103 for optimum output.

9. Retune the receiver and signal generator to 140 mc and see whether any adjustment of trimmers or coils here makes an improvement in output. If it does, retune to 110 mc and check all adjustments.

10. Check between 140 mc and 110 mc until no adjustment at one frequency gives an appreciable increase in output from the settings at the other frequency.

(3) ALIGNMENT AND CALIBRATION OF INDICATOR.

(a) Normal adjustment and calibration of indicator is covered in detail in Section 3, paragraph 6.

(b) ALIGNMENT PROCEDURE WHEN TUBE SELECTION IS NECESSARY.

1. Determine which modulator pair is unbalanced by observing side of circular pattern on which flat appears. If the flat is on the top or bottom of the pattern, the vertical modulators (V119 and V120) are unbalanced; if on the right or left, the horizontal modulators (V117 and V118) are unbalanced.

2. Select a type 6AS6 tube (preferably one which has been aged) and substitute it for one of the tubes in the unbalanced modulator.

3. Perform steps *6b* to *6d* in Section 3 to approach a circular pattern on the screen.

4. Discard the tube which was replaced if the circle now meets the accuracy requirements (no radius on periphery shorter than the maximum radius by more than 1/8 inch).

5. If, after step *3* is performed, the circle is still distorted, leave the new tube in place and replace the other modulator tube with its original companion tube.

6. Perform step *3* and, if circularity is still below standard, select another *new* tube and repeat from step *2.*

7. Continue until specified condition of circularity is reached.

(4) TROUBLE SHOOTING TRANSMITTER T–207A/URD–2.—Since the transmitter circuits are simple and require no special technique, such as alignment or calibration, a simple series of tests will be prescribed to cover most of the possible causes of trouble that may be encountered in operating the transmitter.

(a) ELECTRICAL TESTS.

1. Check "A" and "B" battery voltages. These should be within 10 per cent of their rated value for satisfactory operation.

2. Check battery plugs for good contact, and battery leads for continuity.

3. Check tube.

TABLE 7–2. WINDING AND COIL DATA CHART

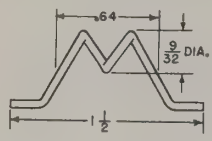
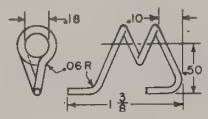
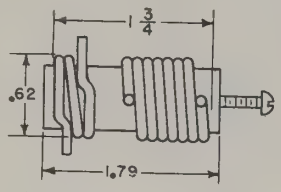
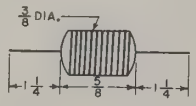
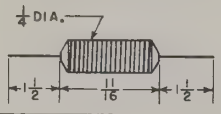
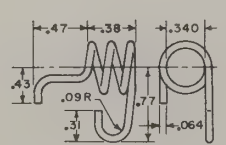
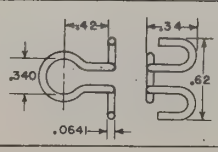
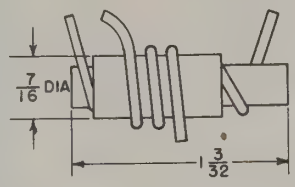
SYMBOL	BENDIX PART NO.	DIAGRAM	WIRE SIZE AND NO. OF TURNS	RESISTANCE D-C	NAVY TYPE NO.	REMARKS
L101	A215604		Soft-drawn tinned copper, #14 AWG. 1-1/2 turns.			Antenna coil.
L102 L103	A215605		Soft-drawn tinned copper, #14 AWG. 1-3/4 turns.			R-f coil.
L104	C215580–1		Two windings, single layer. Pri—7 turns #16 tinned copper wire. Sec—Approx. 1-3/4 turns #16 tinned copper wire. Wound on ceramic form for iron core tuning.			Oscillator coil.
L105 L302 L303	C215092–1		Single layer #38E wire, 50 turns.	3.3Ω	471660	3 uh.
L106	AA104301		Single layer 38 turns #28E wire.	.16Ω		
L107	A213002		25 layers #31E wire, 87 turns per layer (2160 turns).	120Ω	303453	7 hy, 75 ma d.c. Hermetically sealed, varnish impregnated, whole assembly compound sealed.
L108 L110 L111 L112 L113 L114 L115	L215564–1		Ten turns #22, tinned copper wire, wound on molded phenolic form.	.024Ω		Part of i-f transformer.
L109	L215564–2		Ten turns #22 tinned copper wire-tapped at 5-1/4 turns, wound on molded phenolic form.	.024Ω		Part of i-f transformer.
L116 L117	L215564–3		15 turns #22 tinned copper wire, wound on molded phenolic form.	.035Ω		Part of i-f transformer.
L118 L119	C215551–1		Single layer — approx. 42 turns #22E wire, wound on 1-1/2 lg. x 3/8 'dia. form.	.067Ω		Power input filter.
L301	A215539		Air wound, 2-1/2 turns #14 AWG soft-drawn tinned copper wire.			Transmitter oscillator.
L304	A215538		Air wound, 1 turn #14 AWG soft-drawn tinned copper wire.			Transmitter antenna coil.

TABLE 7–2. WINDING AND COIL DATA CHART—(Continued)

SYMBOL	BENDIX PART NO.	DIAGRAM	WIRE SIZE AND NO. OF TURNS	RESISTANCE D-C	NAVY TYPE NO.	REMARKS
L401	C215592–1		2 windings, concentric outer form, 2-1/4 turns #22 AWG bare copper wire, inner form—6 turns, #18 AWG bare copper wire.			Sense coupling coil in antenna goniometer.
T101	C217128		*Pri.* (term. 1 & 2) 287 turns #21E wire, 5 layers, 60 turns per layer. *Plate* (term. 5 & 7) 2020 turns #32E wire, tapped at 1010 turns (term. 6) 12 layers, 195 turns per layer. *Fil. #1* (term. 8 & 10) 17 turns #16EP wire, tapped at 8 turns. *Fil. #2* (term. 10 & 11) 17 turns #30E wire. *Fil. #3* (term. 12 & 13) 17 turns #20E wire. *Fil. #4* (term. 14 & 15) 17 turns #24E wire. *Fil. #5* (term. 3 & 4) 13 turns #16EP wire.	Term. 1 & 2—2.10Ω. Term. 5 & 7—225Ω. Term. 8 & 10—.062Ω. Term. 10 & 11—1.35Ω. Term. 12 & 13—.15Ω. Term. 14 & 15—.365Ω. Term. 3 & 4—.055Ω.	304861	Power transformer. All windings insulated 2500v.
T102	C213000		*Pri.* (term. 1 & 2) 560 turns #32E wire, 5 layers, 117 turns per layer. *Plate* (term. 7 & 8) 10,800-1/2 turns #41E wire, 55 layers, 197 turns per layer. *Fil. #1* (term. 5 & 6) 35 turns #24E wire. *Fil. #2* (term. 3 & 4) 7 turns #29E wire.	Term. 1 & 2—36Ω. Term. 7 & 8—7000Ω. Term. 5 & 6—.56Ω. Term. 3 & 4—.39Ω.	303451	Insulated 1500v. Pri. 1500v. Sec. #1. 5000v. Sec. #2. 5000v. Sec. #3. Scope transformer.
T103 T104	C217126		*Pri.* (term. 1 & 2) 4800 turns #41E wire, 27 layers, 180 turns per layer. *Sec. #1* (term. 3 & 4) 2400 turns #41E wire, 27 layers, 180 turns per layer. *Sec. #2* (term. 5 & 6) 2400 turns #41E wire, 27 layers, 180 turns per layer.	Term. 1 & 2—1575Ω. Term. 3 & 4—1020Ω. Term. 5 & 6—1020Ω.	304860	Modulation transformer.
T301	A217054		4600 1/2 turns #40E wire, tapped at 2300 turns (term. 1-2), and at 2875 1/2 turns (term. 1-3). Wound in 40 layers of 120 turns per layer.	Term. 1 & 4—890Ω.	304652	Modulation and oscillator transformer.
K401	L218264		24,000 turns #43 wire.	6000 Ω ±10%	291766	Sense relay.

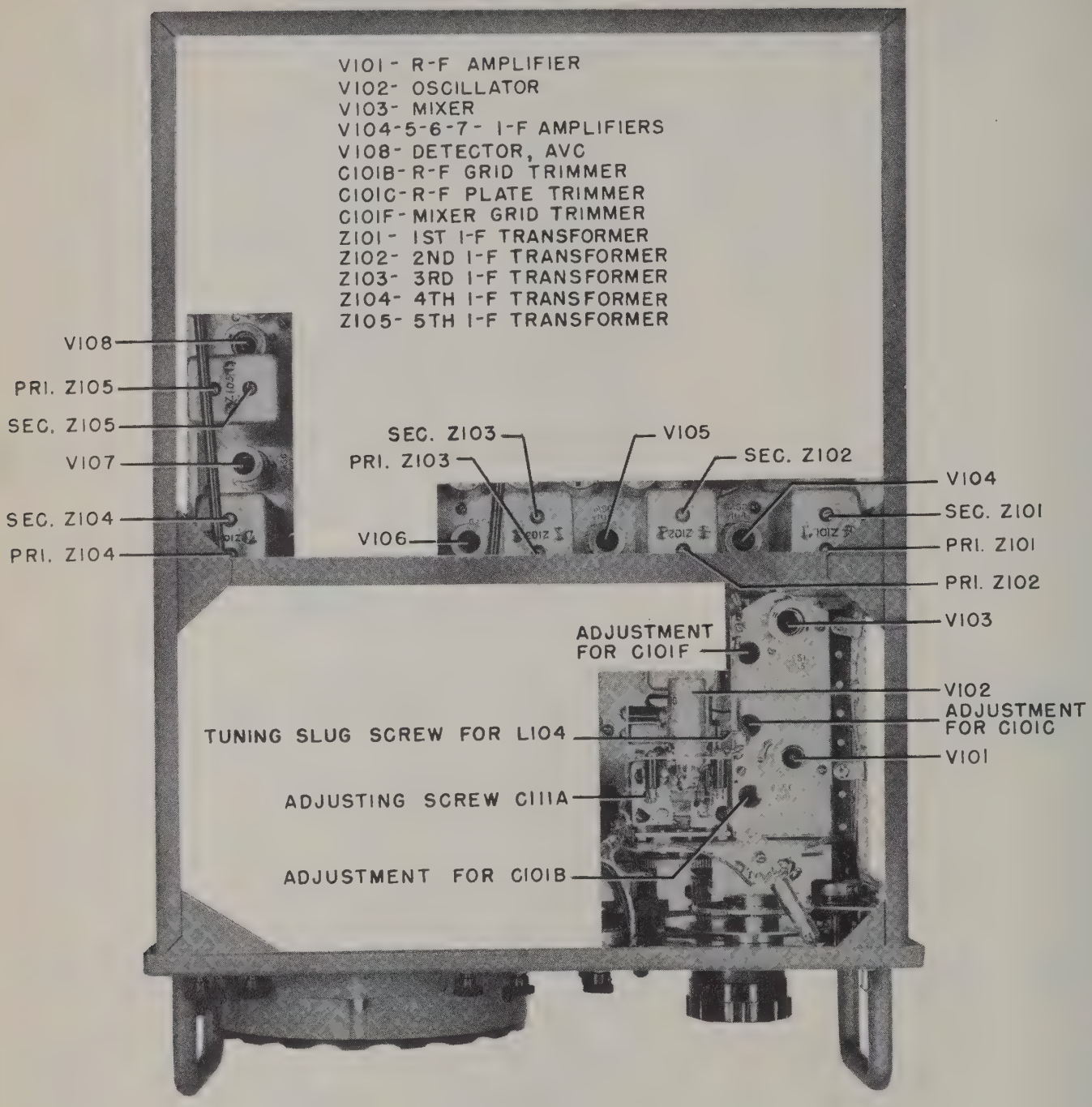


Figure 7–2. Location of I-F and R-F Adjustments

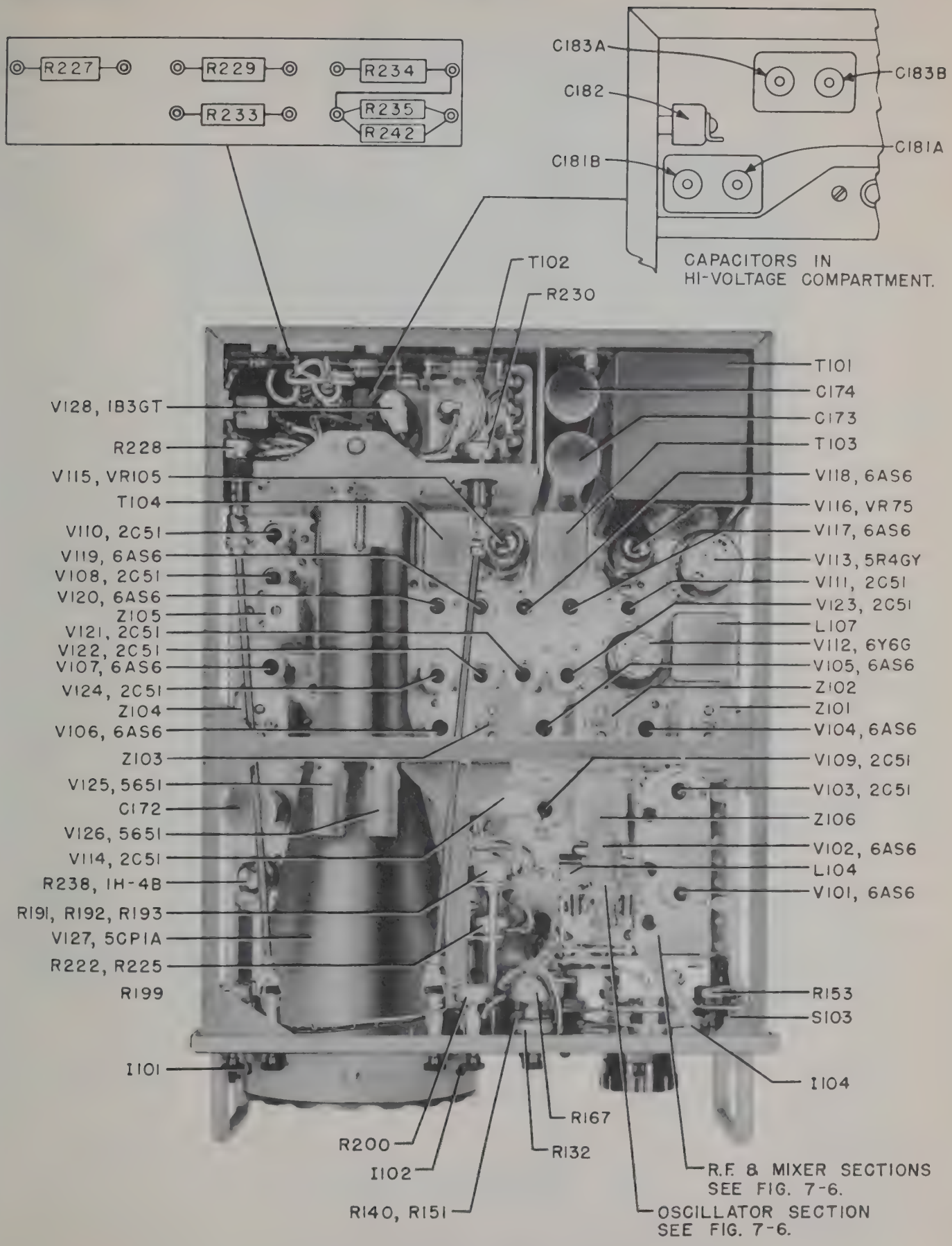


Figure 7–3. Receiver Chassis, Top View

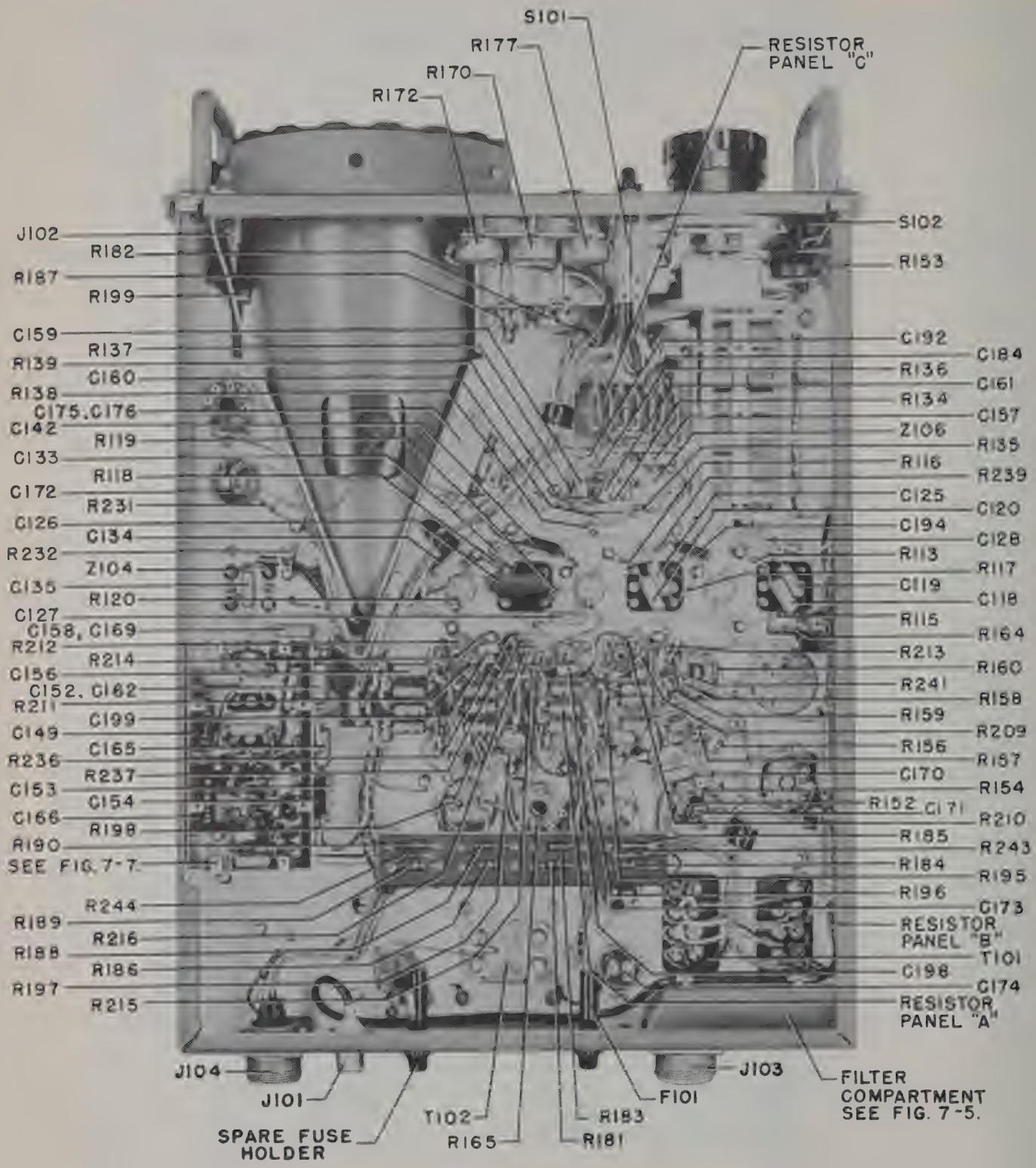
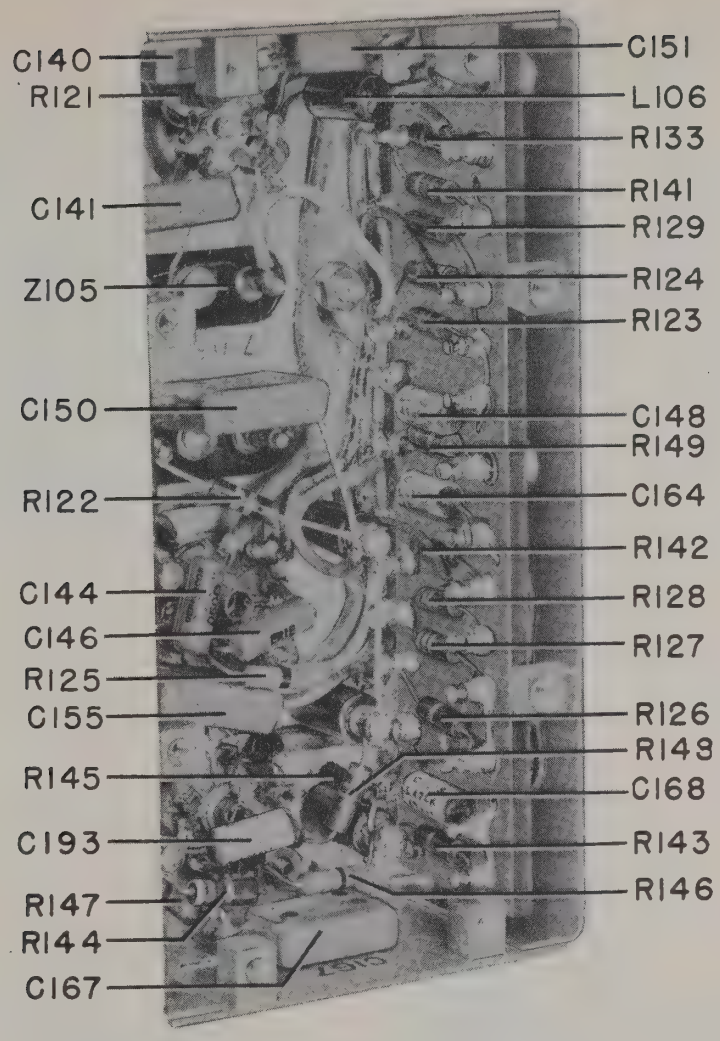


Figure 7–4. Receiver Chassis, Underside View



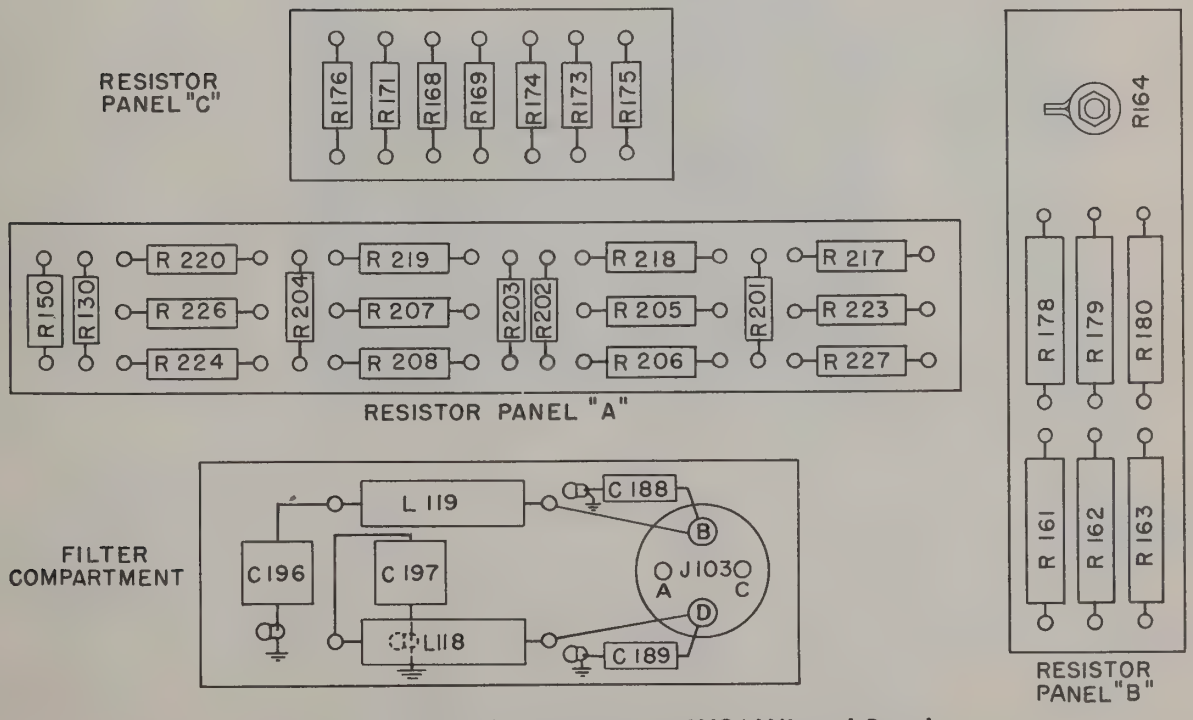
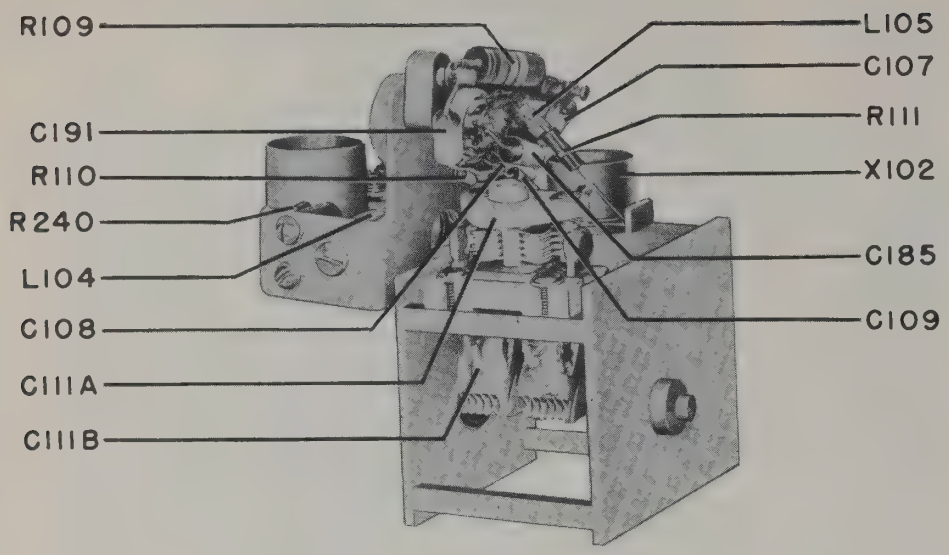
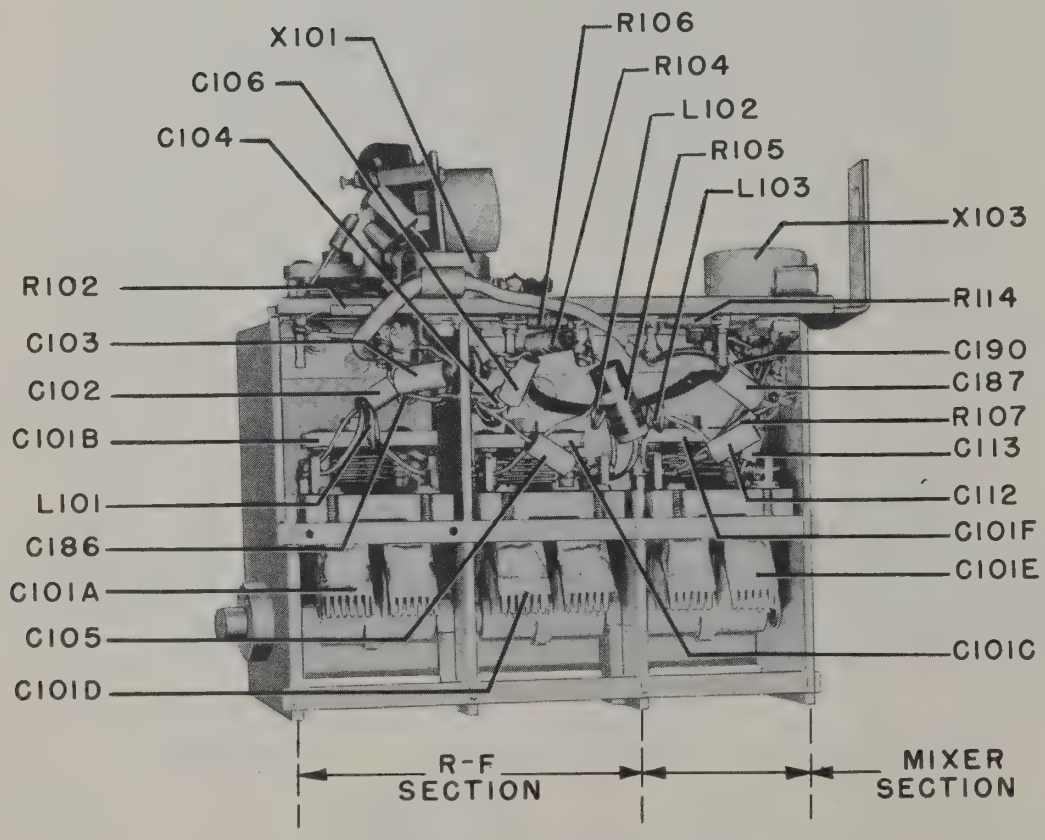


Figure 7–5. Shielded Compartment AVC/ANL and Panels

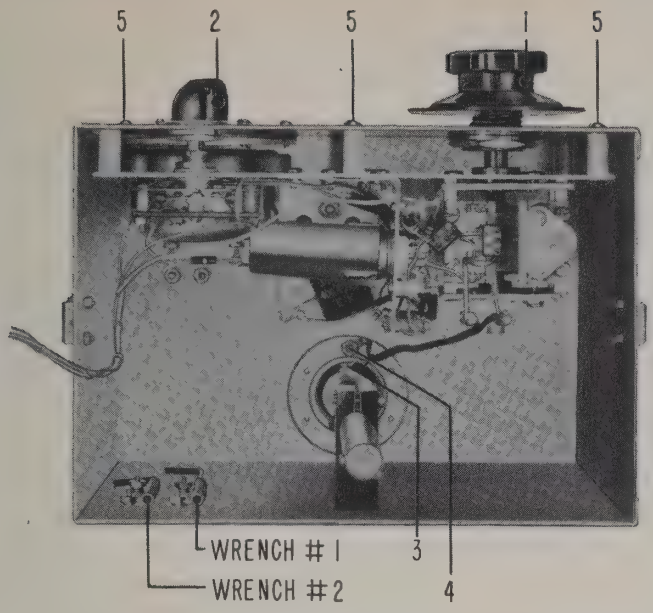


OSCILLATOR SECTION



R-F SECTION

Figure 7–6. R-F and Oscillator Sections



1. Loosen Bristo setscrew with wrench #1 and remove dial knob.
2. Loosen Bristo setscrew, using wrench #2, and remove pointer knob.
3. Unsolder antenna lead.
4. Remove nut, grounding lug, and lock washers from ground side of twin lead.
5. Remove six #6–32 screws.
6. Slide entire chassis out.

Figure 7–7. Disassembly of Target Transmitter

4. Check the transformer, T301, for open circuits between terminals 1 and 3, 2 and 4.

5. Check individual resistors and capacitors for change in value, shorting, or open circuits.

(b) DISASSEMBLY OF TRANSMITTER.— Figure 7–7 shows the complete disassembly procedure for the transmitter. Installation of the batteries is covered in Section 3, paragraph 4*c*.

b. REPLACEMENT OF PARTS.

(1) REPLACEMENT OF ROTATING CAPACITOR ASSEMBLY C401 IN ANTENNA AS–410/URD–2.

(a) REMOVAL OF ROTATING CAPACITOR. (See figure 7–11.)

1. Unscrew all antenna elements to prevent damage while disassembling the antenna.

2. Remove the 6 screws from the base of housing cap A403 and remove cap and gasket E409.

3. Unsolder the 8 ribbon leads to rotating capacitor assembly C401 from antenna element E446 lead-in terminals.

4. Unsolder the 2 connections (twin-lead) from bazooka W402 to the sense coil on the rotating capacitor (unsolder at bazooka end), and the single wire from wave-guide ("bazooka") W401 to the sense relay on this capacitor.

5. Take the four screws, which hold bazooka to casting, out of the top of each bazooka.

6. Remove the six screws, which hold the support casting A401 to the housing E408, and separate the casting and housing. When the casting is lifted it will have attached to it the motor, B401; alternator (sine-wave generator) and tone-wheel E445; and the capacitor, C405. The connecting cable has enough slack to permit withdrawal of the whole assembly without disconnecting any part thereof. Figure 7–8 shows the assembly as removed from housing.

7. Loosen the upper Allen setscrew (#10) in shaft coupling O402.

8. With a #5 Allen wrench remove the four #8 Allen-head screws which hold the rotating capacitor assembly to the bottom of casting A401. The heads of these screws are located between motor B401 and the casting.

9. Lift rotating capacitor assembly out.

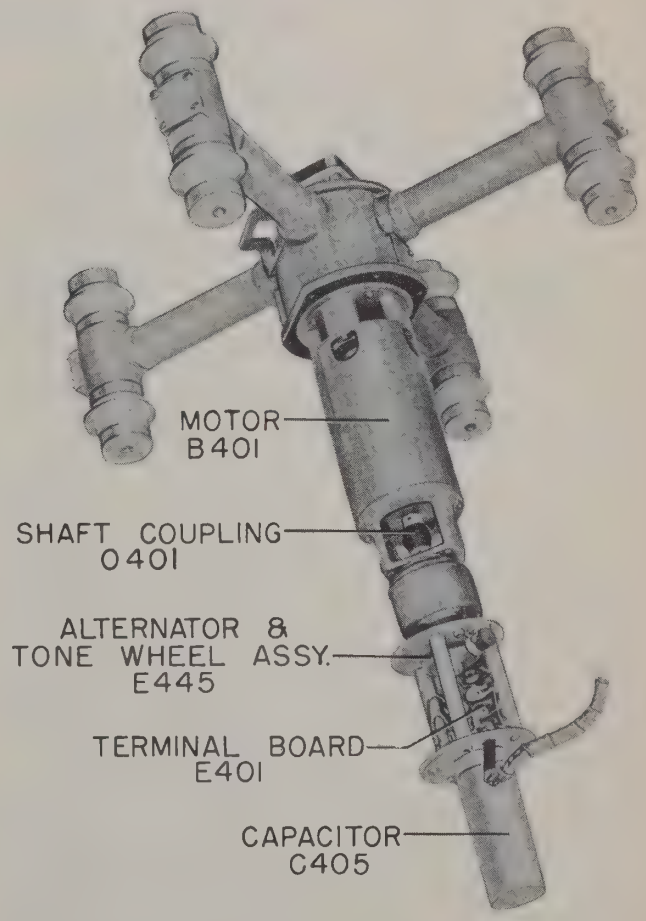


Figure 7–8. Antenna Sub-assembly

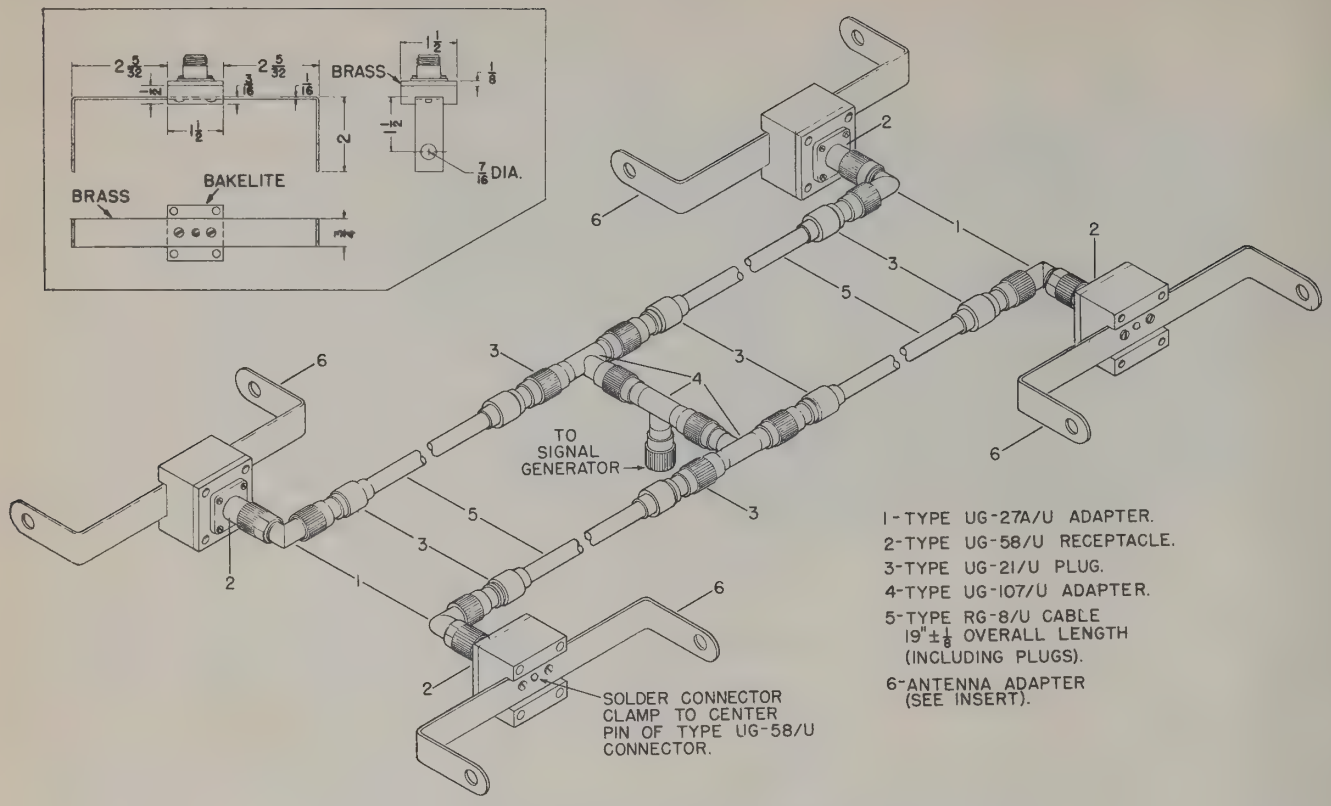


Figure 7–9. Testing Cable Assembly, Constructional Details (Bendix Part No. 212653)

(b) INSTALLATION OF ROTATING CAPACITOR.

1. Reverse procedure outlined in (*a*) *1* to *9,* except perform the following operation before fastening the rotating capacitor in place. (This is required due to irregularities in the surface of casting A401. The copper shims must be used to provide a suitable ground connection for the rotating capacitor.)

a. Set capacitor in place on raised bosses in casting A401 and test with the fingers to see if capacitor will rock in any direction.

b. If capacitor rocks, place soft copper shims of 0.002 inch thickness, 3/8 inch O.D. between the boss and the capacitor post which do not meet until no appreciable rocking is noted; place a 0.005 inch thick x 3/8 inch O.D. soft copper shim under *each* post and fasten capacitor in place.

c. If capacitor does not rock, place a 0.005 inch x 3/8 inch O.D. shim under each post and fasten capacitor in place.

2. BALANCING ANTENNA. — Whenever the twin-lead to the sense coil is unsoldered, *for any reason,* the antenna must be balanced. With equal signals applied to all four elements of the antenna through the test cable assembly, capacitor C404 and the twin-lead are adjusted to give greatest circle diameter. This procedure is described in detail as follows:

a. Bolt the four copper brackets of the Test Cable Assembly (figure 7–9, Bendix Part No. N212653) to the eight antenna element threaded sockets (see figure 7–10) and screw the four type UG–21/U fittings on the ends of the "octopus" cables into the receptacles on the brackets. Connect the output of a UHF Signal Generator Equipment, Navy Model LX (series) or equivalent, through its output cable and attenuator to the above test cable assembly. Keep the cable between the attenuator and the test cable assembly as short as possible.

b. Turn receiver and signal generator ON and tune to 110 mc.

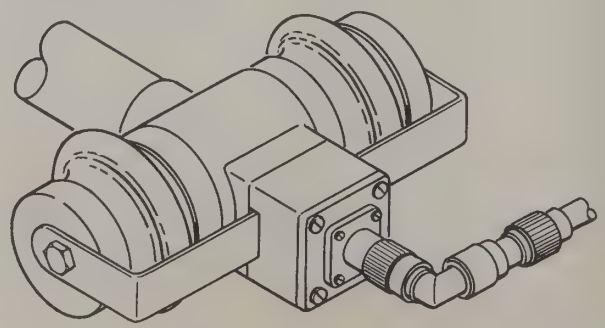
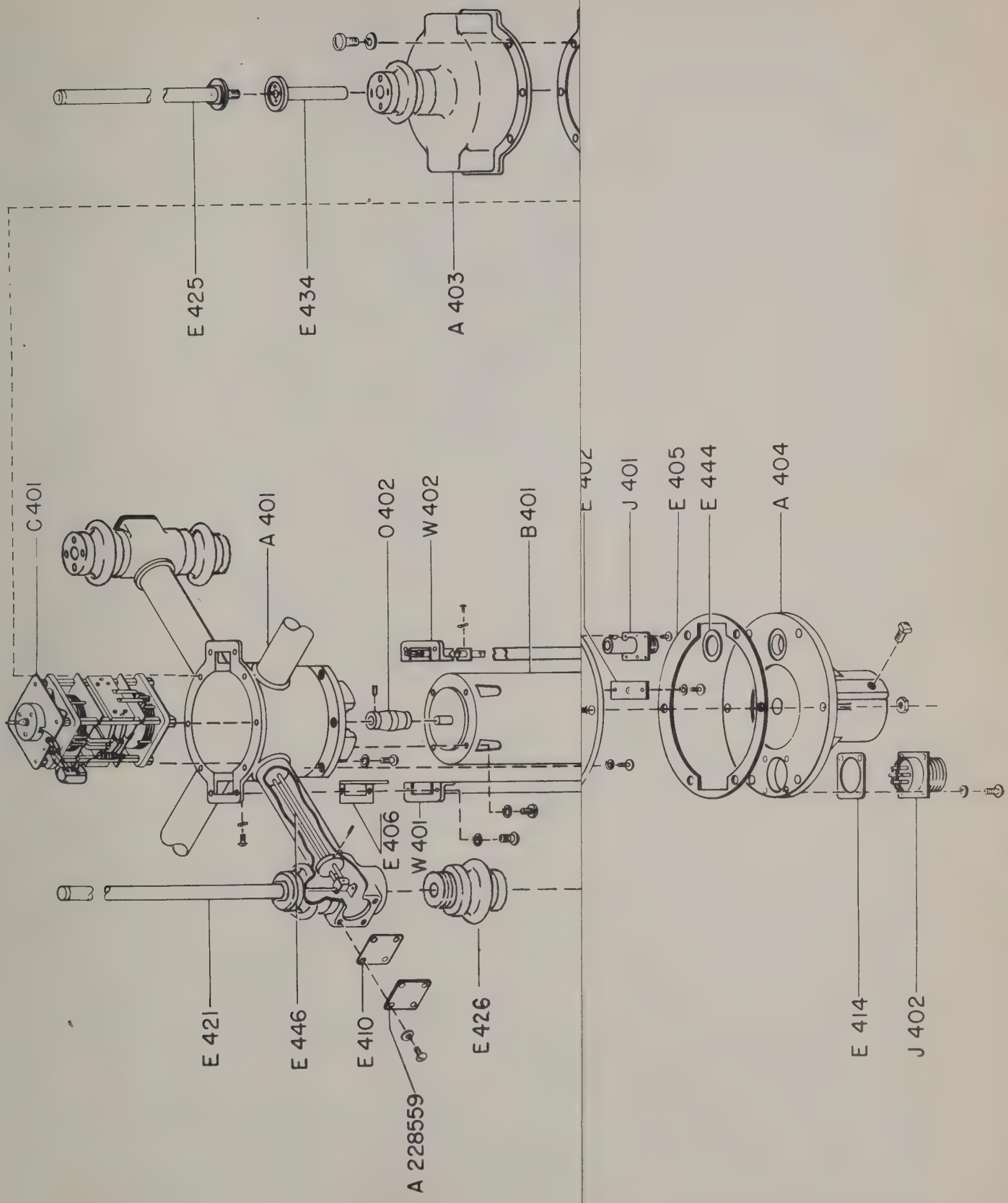


Figure 7–10. Method of Attaching Test Cable Bracket to Antenna



...heter, Exploded View

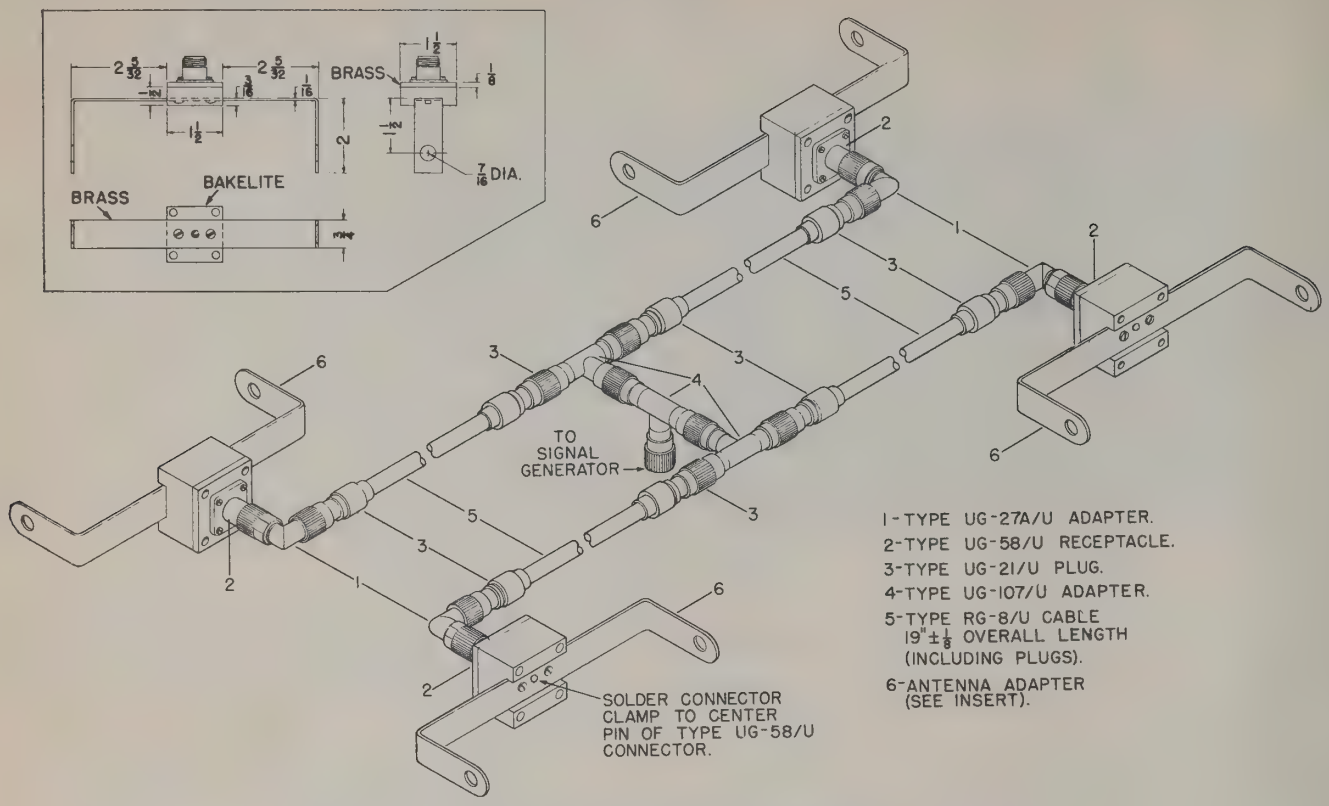


Figure 7–9. Testing Cable Assembly, Constructional Details (Bendix Part No. 212653)

(b) INSTALLATION OF ROTATING CAPACITOR.

1. Reverse procedure outlined in (*a*) *1* to *9,* except perform the following operation before fastening the rotating capacitor in place. (This is required due to irregularities in the surface of casting A401. The copper shims must be used to provide a suitable ground connection for the rotating capacitor.)

a. Set capacitor in place on raised bosses in casting A401 and test with the fingers to see if capacitor will rock in any direction.

b. If capacitor rocks, place soft copper shims of 0.002 inch thickness, 3/8 inch O.D. between the boss and the capacitor post which do not meet until no appreciable rocking is noted; place a 0.005 inch thick x 3/8 inch O.D. soft copper shim under *each* post and fasten capacitor in place.

c. If capacitor does not rock, place a 0.005 inch x 3/8 inch O.D. shim under each post and fasten capacitor in place.

2. BALANCING ANTENNA. — Whenever the twin-lead to the sense coil is unsoldered, *for any reason,* the antenna must be balanced. With equal signals applied to all four elements of the antenna through the test cable assembly, capacitor C404 and the twin-lead are adjusted to give greatest circle diameter. This procedure is described in detail as follows:

a. Bolt the four copper brackets of the Test Cable Assembly (figure 7–9, Bendix Part No. N212653) to the eight antenna element threaded sockets (see figure 7–10) and screw the four type UG–21/U fittings on the ends of the "octopus" cables into the receptacles on the brackets. Connect the output of a UHF Signal Generator Equipment, Navy Model LX (series) or equivalent, through its output cable and attenuator to the above test cable assembly. Keep the cable between the attenuator and the test cable assembly as short as possible.

b. Turn receiver and signal generator ON and tune to 110 mc.

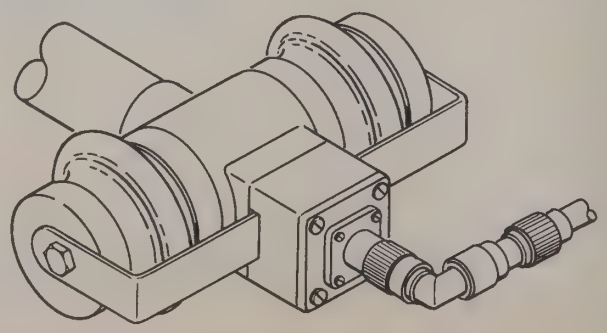


Figure 7–10. Method of Attaching Test Cable Bracket to Antenna

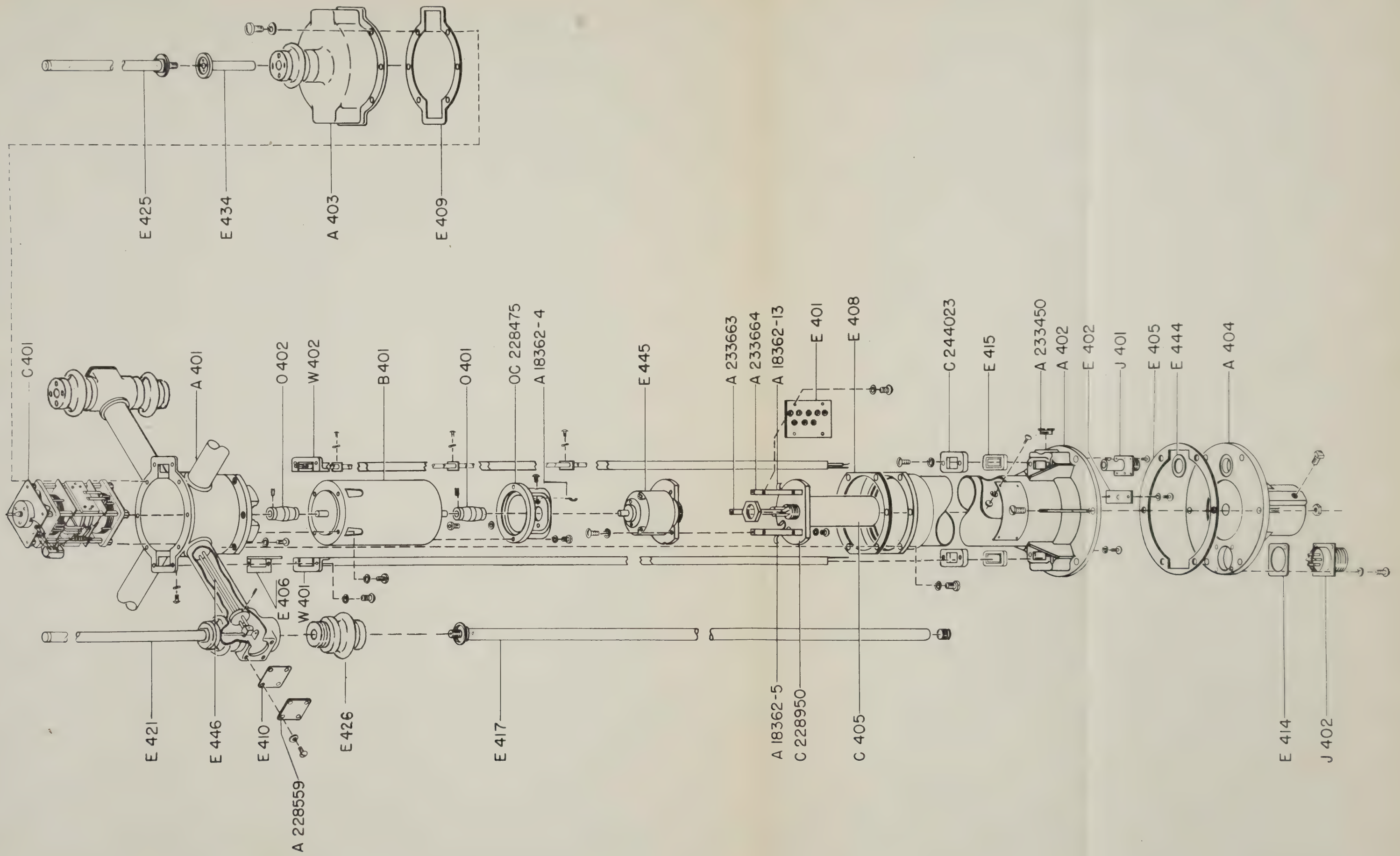


Figure 7–11. Antenna and Goniometer, Exploded View

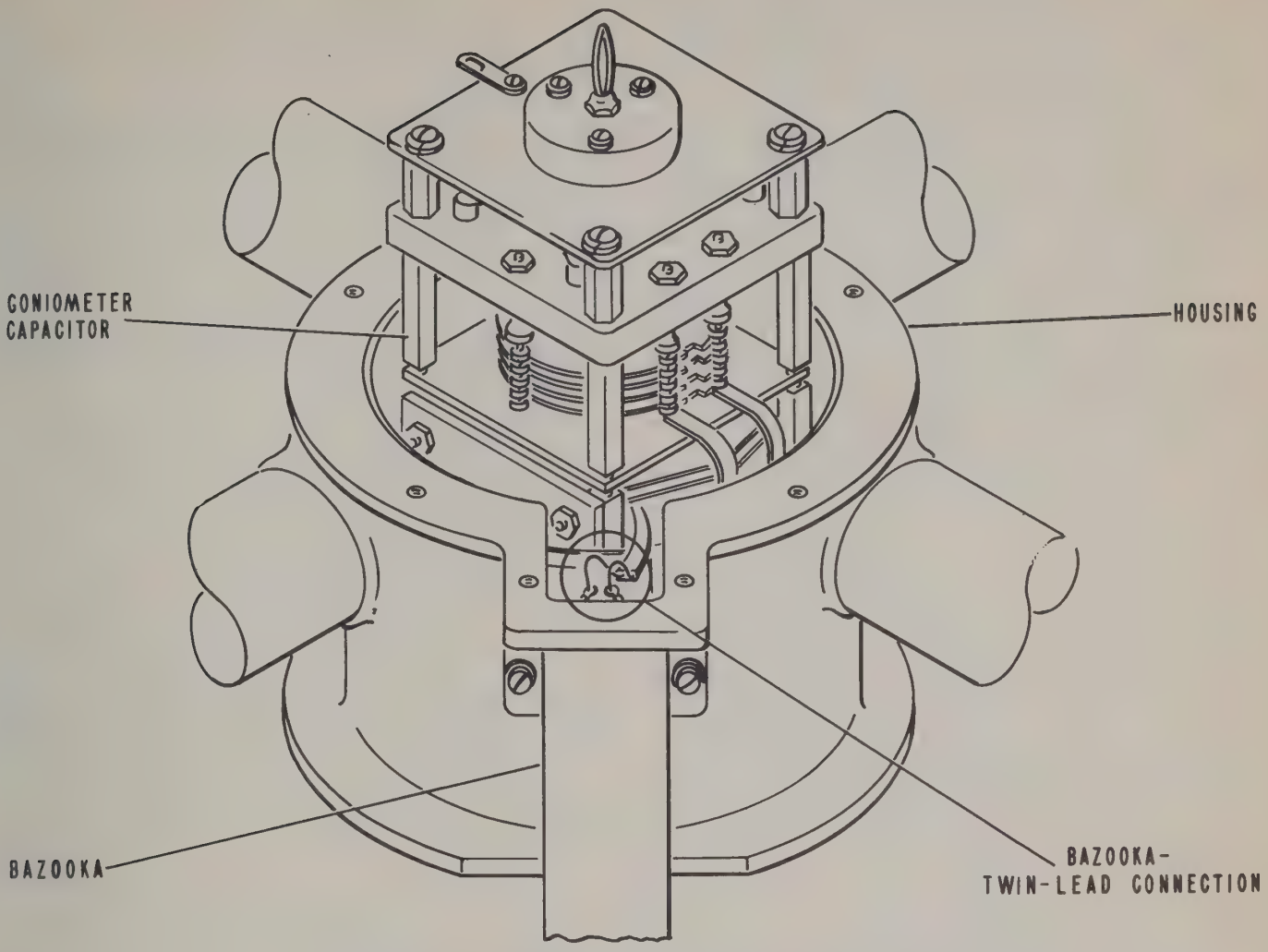


Figure 7–12. Twin-lead to Bazooka Connection

c. Place the R-F SENS control fully clockwise, the motor switch ON, and the CAL-SENSE switch to neutral or center position.

d. Raise the signal input, unmodulated, to a level of about 10,000 μV. Antenna unbalance will be evidenced by a reduction in the circle diameter or a change in shape from circular.

e. Adjust the signal generator to cause the circle to contract to about one-half of its normal diameter; then adjust capacitor C404 to obtain largest circle diameter.

f. Increase signal generator output to diminish circle diameter again, and tune C404 for maximum. (See figure 7–18.) Repeat until C404 has no more effect.

g. Tune signal generator and receiver to 140 mc.

h. Determine which wire of the twin-lead needs shortening by gently touching each wire at the stripped portion (at bazooka connection, see figure 7–12) and observing which side causes the circle pattern to contract upon being touched.

i. With a pair of long-nosed pliers, put a small kink in this lead. (Make this kink a hairpin-shaped affair which folds back on itself, to prevent any inductive effects). Increase or decrease the size of the kink to give maximum circle diameter.

j. Tune signal generator and receiver back to 110 mc and readjust trimmer C404 for maximum diameter, raising signal generator output if necessary to keep the circle diameter from reaching the edge of the tube screen.

k. Tune signal generator and receiver to 140 mc and adjust length of twin-lead again to give maximum circle diameter.

l. Repeat steps j and k until no further increase in circle diameter is noted when the input signal is increased.

3. Complete reassembly of antenna by replacing gasket E409 and cap A403 and screwing dipole elements and sense antenna element in place. The arrow on the cap must now be re-oriented.

4. RE-ORIENTATION OF ANTENNA ARROW.—Since the phase relationship existing between the rotating goniometer capacitor (C401) and the alternator (E445) is destroyed when the relative shaft positions of the two are disturbed, it is necessary to re-orient the arrow after replacement of the capacitor.

This is done instead of trying to attain original relative shaft positions. In other words, the shaft relationship affects the directivity of the antenna, but any shaft relationship will work as long as the directivity of the antenna is known.

a. Remove arrow from cap A403 by scratching off with a knife, sanding, or using some other abrasive.

b. Set up Tripod CBJO–10610 directly north of the antenna mast, or in whichever direction it is desired the antenna should be oriented. Magnetic Compass CAZA–10666 may be mounted atop the tripod to facilitate positioning as shown in figure 3–5.

c. Mount Target Transmitter T–207A/URD–2 on the tripod as shown in figure 3–5, extend the antenna, and turn the switch to CW, at a frequency of about 120 mc.

d. Turn the receiver ON and tune in the target transmitter signal, noting true (sense) and bi-directional (propeller-pattern) bearings.

e. Loosen the antenna setscrews (8 of figure 7–13) at the bottom of the antenna housing and rotate the antenna on the mast until the propeller lobe in the "sense" direction is nearly at 0° on the azimuth scale. A setting within about ±4° of the 0° mark will suffice.

f. Place the tip of the propeller blade exactly on the azimuth scale zero as described in Section 3, paragraph 6*b*(4) and (5).

g. Repaint the directional arrow on the top of the antenna to point to the new "North."

(2) REPLACEMENT OF MOTOR B401 IN ANTENNA AS–410/URD–2.

(a) REMOVAL OF MOTOR. (See figure 7–8 for this procedure.)

1. Repeat steps *b*.(1)*(a)1, 2, 4, 5, 6* and *7*.

2. With a #5 Allen wrench take out the four screws in the end of Motor B401 housing, which are accessible through the elongated holes in the frame of the motor.

3. Carefully lift the casting A401 off and lay it aside.

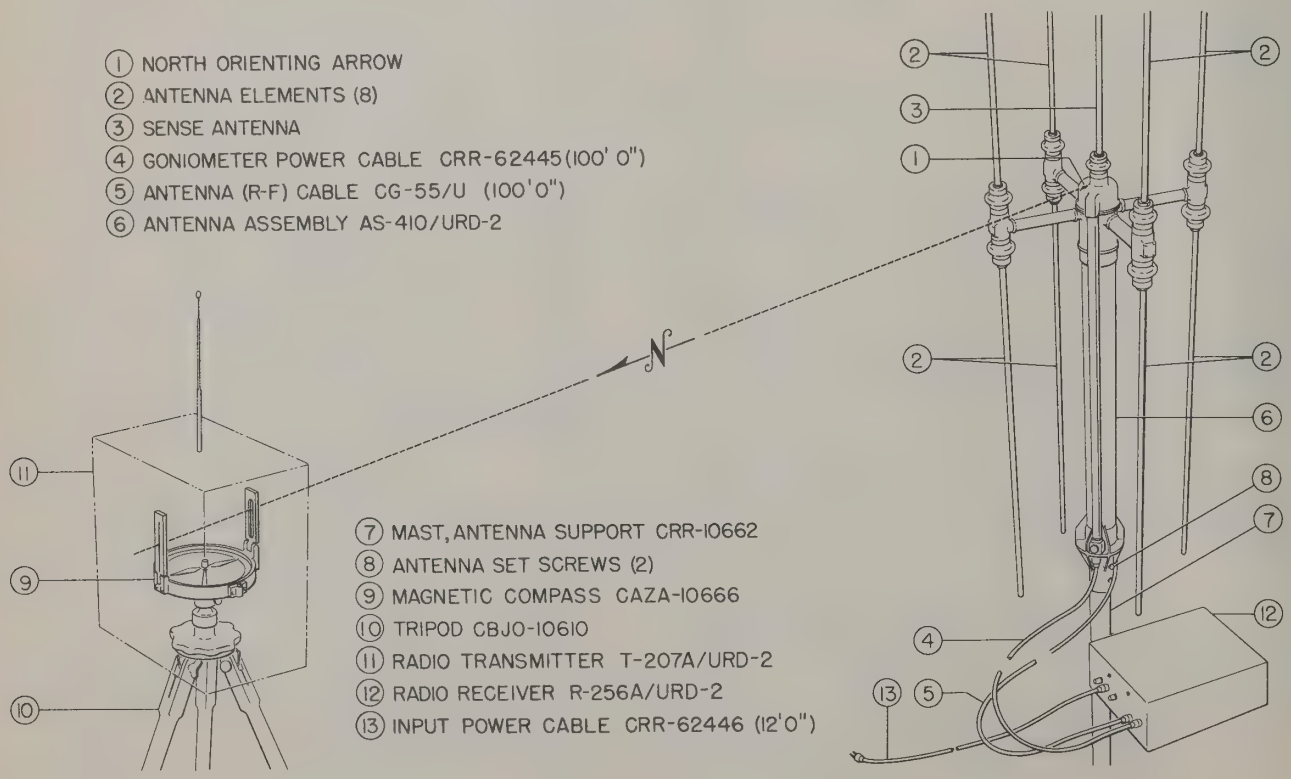

① NORTH ORIENTING ARROW
② ANTENNA ELEMENTS (8)
③ SENSE ANTENNA
④ GONIOMETER POWER CABLE CRR-62445(100' 0")
⑤ ANTENNA (R-F) CABLE CG-55/U (100'0")
⑥ ANTENNA ASSEMBLY AS-410/URD-2
⑦ MAST, ANTENNA SUPPORT CRR-10662
⑧ ANTENNA SET SCREWS (2)
⑨ MAGNETIC COMPASS CAZA-10666
⑩ TRIPOD CBJO-10610
⑪ RADIO TRANSMITTER T-207A/URD-2
⑫ RADIO RECEIVER R-256A/URD-2
⑬ INPUT POWER CABLE CRR-62446 (12'0")
N

Figure 7–13. Orientation of Antenna

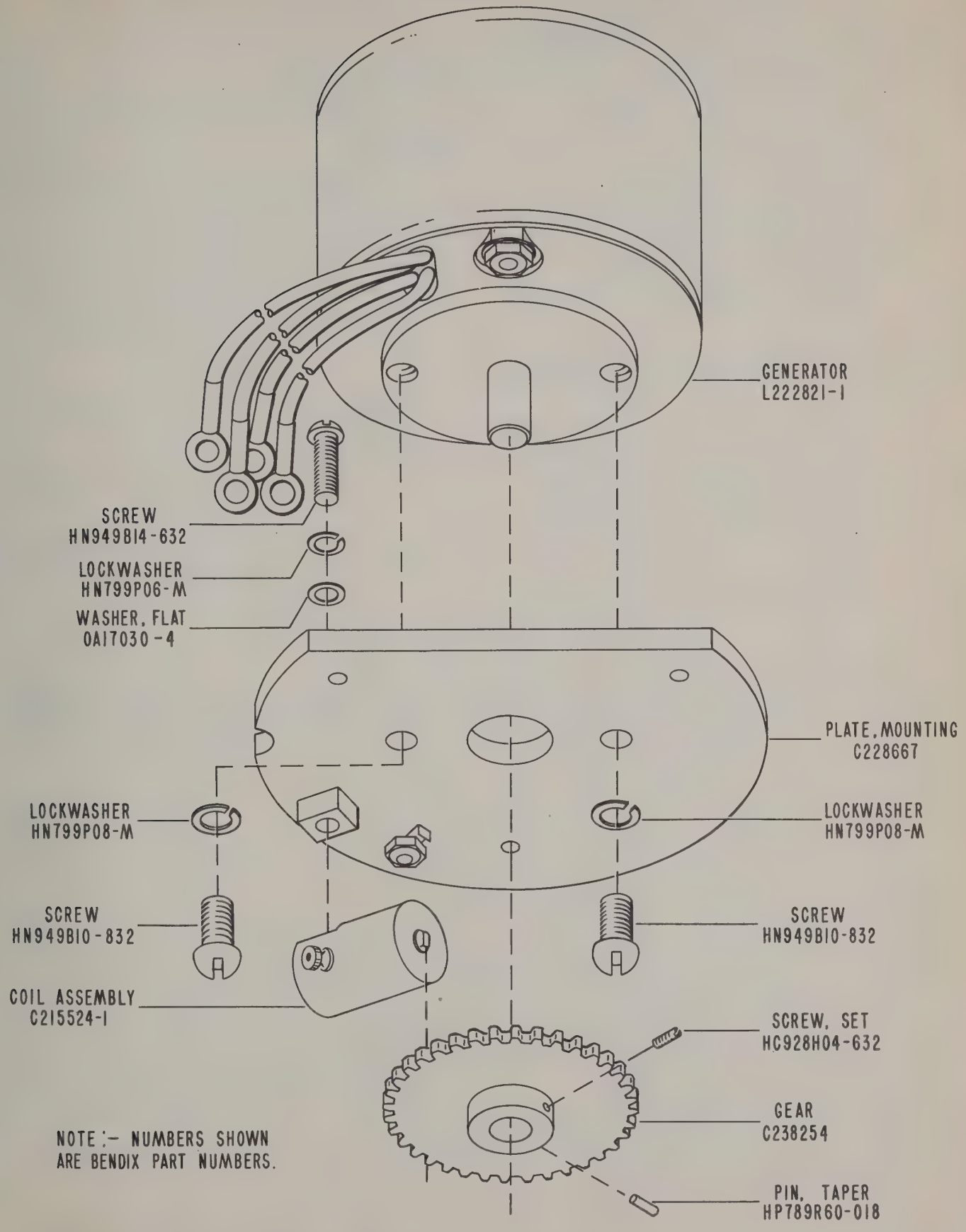


Figure 7–14. Alternator-Tone-wheel Assembly E445, Exploded View

4. Remove the two Allen-head bolts (use #5 Allen wrench) which hold Motor Mounting Bracket OC228475 to the motor, loosen setscrews in coupling O401, and slide motor off of shaft.

(b) INSTALLATION OF MOTOR.

1. Reverse steps (2)(*a*), *1* to *4*.

2. Re-orient antenna arrow as in *(b)4*.

(3) REPLACEMENT OF ALTERNATOR AND TONE-WHEEL ASSEMBLY E445.

(a) REMOVAL OF ASSEMBLY E445.

1. Follow procedure outlined in paragraph (2)(*a*).

2. Remove the three screws in the base plate of E445 which are screwed into support-posts A233663 and A233664. Separate E445 from the posts.

3. Two screws holding the motor mounting frame to the alternator and tone-wheel assembly may now be removed to separate the two parts if necessary.

(b) INSTALLATION OF ASSEMBLY E445.

1. Reverse procedure outlined in paragraph (3)(*a*).

2. Re-orient antenna arrow as in (1)(*b*)*4*.

(c) ADJUSTMENT OF TONE-WHEEL PICK-UP COIL. (See figure 7–14.)

1. Loosen the screw which holds the pick-up coil E403 in place.

2. Connect a vacuum-tube voltmeter across the output terminals of the coil and turn the motor switch ON.

3. Adjust the coil by carefully moving it in or out until the output is 0.45 volts ±0.01 volt. In adjusting the coil, try to keep its axis along a radius of the tone-wheel, thus maintaining tangency and, consequently, pure sinewave output.

4. Tighten screw and check voltage again.

(4) REPLACEMENT OF ANTENNA ELEMENT FEED-THROUGH INSULATORS.

CAUTION

USE NO OTHER INSULATOR THAN NUMBER E426 WHICH IS SUPPLIED WITH THE SET.

(a) Screw insulator E426 into the crossarm bracket of the antenna.

(b) Screw antenna element into insulator and tighten with a 3/4-inch wrench. In tightening element be careful not to damage insulator.

TABLE 7–3. ELECTRON TUBE CHARACTERISTICS

TUBE TYPE	FILAMENT		PLATE VOLTAGE	GRID BIAS VOLTS	SCREEN VOLTS	PLATE CURRENT (ma)	SCREEN CURRENT (ma)	PLATE RESISTANCE (OHMS)	AMPLIFICATION FACTOR	TRANSCONDUCTANCE (MICROMHOS)
	AMPS	VOLTS								
JAN–1B3GT	0.2	1.25	2100							
JAN–2C51	0.3	6.3	150	—2		8.2			35	5500
JAN–3A5	0.2	1.4	135	—3		4.1		8300	15	1800
JAN–5CP1A	0.6	6.3	320	—1750	—1100					
JAN–5R4GY	2.0	5.0	440			200				
JAN–6AS6	0.175	6.3	120	—2	120	5.5	3.5			3500
JAN–6Y6G	1.25	6.3	135	—13.5	135	60.0	3.0	9300		7000
JAN–VR75			75			5–40				
JAN–VR105			105			5–40				
JAN–5651			87			1.5–3.5				
1H–4B	Ballast resistor—29 ohms									

TABLE 7–4. ELECTRON TUBE OPERATING VOLTAGES AND CURRENTS.

TUBE TYPE	FUNCTION	PLATE VOLTAGE	PLATE CURRENT (ma)	SCREEN VOLTAGE	SCREEN CURRENT (ma)	SUPPRESSOR VOLTAGE	CATHODE VOLTAGE	GRID VOLTAGE	HEATER VOLTAGE (A-C)
JAN–1B3GT	HV Rectifier	2100							1.25
JAN–2C51	Mixer	66	6.1				0	−10.5	6.3
	Detector	−10					−3.5	−10	6.3
	avc	−11					−78	−82	6.3
	Audio amplr.	75	6.9				1.3	0	6.3
	Audio amplr.	200	10.2				3.0	0	6.3
	Noise amplr.	170	9.1				7.5	11	6.3
	Noise rectifier	3					7.5	3.3	6.3
	Voltage regulator	165	9.0				72	70	6.3
	Tone Amplr.	75	6.8				1.4	0.45	6.3
	Cathode follower	195	10.0				−9	−20	6.3
	Horizontal voltage regulator	135	7.2				73	70	6.3
	Vertical voltage regulator	440	18.0				146	135	6.3
	Circle amplr. (Horizontal)	320	17.0				117	112	6.3
	Circle amplr. (vertical)	320	17.0				117	112	6.3
JAN–3A5	R-f oscillator	135	4.1					−3	1.4
	A-f oscillator	135	4.5					−2	1.4
JAN–5CP1A	KRT	320		−1100				−1750	6.3
JAN–5R4GY	Low voltage rectifier	440	200						5.0
JAN–6AS6	R-f amplr.	165		160		0	0	0	6.3
	Oscillator	120	5.5	120	3.5	120	0	−11	6.3
	1st I-f amplr.	190	11.1	190	4.9	0	0	−7	6.3
	2nd I-f amplr.	190	11.1	190	4.9	0	0	−7	6.3
	3rd I-f amplr.	190	11.1	190	4.9	0	0	−7	6.3
	4th I-f amplr.	110	5.0	110	3.0	1.8	1.8	0	6.3
JAN–6Y6G	Voltage regulator	440	60	440	3.0		205	170	6.3
JAN–VR75	Voltage regulator	75	5–40						
JAN–VR105	Voltage regulator	105	5–40						
JAN–5651	Voltage regulator	85	1.5–3.5				170		
	Voltage regulator	0	1.5–3.5				85		
1H–4B	Voltage regulator	Resistor—29 ohms							

V125 5651		
N	VOLTS	RES.
P	85	220K
K	170	360K
C		NC
K	170	360K
P	85	220K
C		NC
K	170	360K

V106 6AS6			
PIN		VOLTS	RES.
1	G_1	-7	1 MEG.
2	K	0	0.0
3	H	6.3AC	0.25
4	H	GR	0.0
5	P	190	60K
6	G_2	190	60K
7	G_3	0	0.0

CAL"
O/F"

V105 6AS6			
PIN		VOLTS	RES.
	G_1	-7	1 MEG.
	K	0	0.0
	H	6.3AC	0.25
	H	GR	0.0
	P	190	60K
	G_2	190	60K
	G_3	0	0.0

NOTES-

1.- ISOLATED FILAMENTS- 6.3 V. AC BETWEEN PINS 1 & 9.

2. ISOLATED FILAMENTS- 6.3 V. AC BETWEEN PINS 2 & 6.

3. ALL VOLTAGE MEASUREMENTS TAKEN WITH 20,000 Ω/VOLT DC, 1,000 Ω/VOLT AC METER UNLESS OTHERWISE STATED. AC TO CHASSIS.

4. ALL VOLTAGES DC UNLESS OTHERWISE STATED.

5. ALL RESISTANCE READINGS TAKEN TO CHASSIS.

6. MEASUREMENTS MARKED "VTVM" TAKEN WITH ELECTRONIC VOLTMETER.

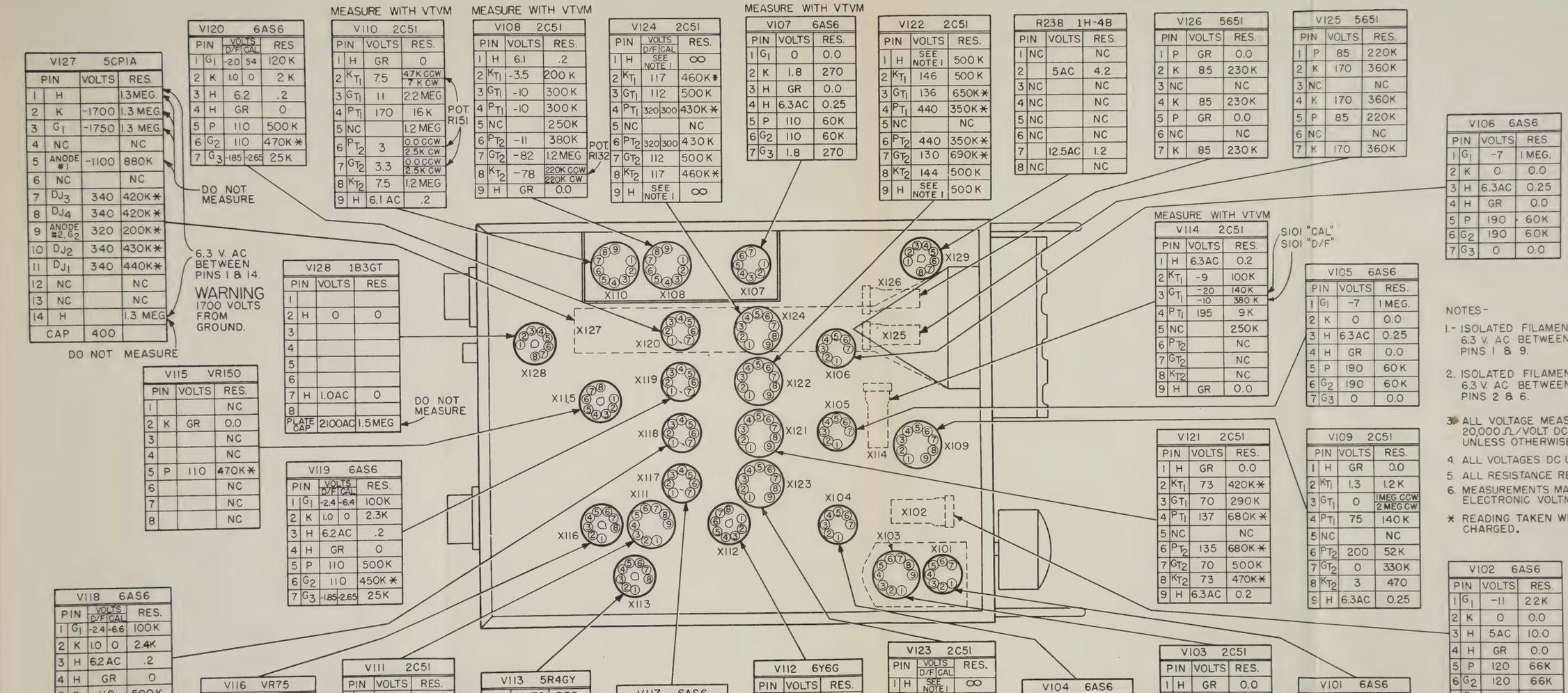
* READING TAKEN WHEN CAPACITOR IS FULLY CHARGED.

V109 2C51			
PIN		VOLTS	RES.
	H	GR	0.0
	K_{T_1}	1.3	1.2 K
	G_{T_1}	0	1MEG CCW 2 MEG CW
	P_{T_1}	75	140 K
	NC		NC
	P_{T_2}	200	52K
	G_{T_2}	0	330K
	K_{T_2}	3	470
	H	6.3AC	0.25

V102 6AS6			
PIN		VOLTS	RES.
1	G_1	-11	22K
2	K	0	0.0
3	H	5AC	10.0
4	H	GR	0.0
5	P	120	66K
6	G_2	120	66K
7	G_3	120	66K

V101 6AS6		
N	VOLTS	RES.
G_1	0	2 MEG.
K	GR	0.0
H	6.3AC	0.25
H	GR	0.0
P	165	55K
G_2	160	63K
G_3	GR	0.0

A/URD-2 Receiver-Indicator, Tube Socket Voltage and Resistance Chart



V127 5CP1A			
PIN		VOLTS	RES.
1	H		1.3MEG.
2	K	-1700	1.3 MEG.
3	G_1	-1750	1.3 MEG.
4	NC		NC
5	ANODE #1	-1100	880K
6	NC		NC
7	DJ_3	340	420K*
8	DJ_4	340	420K*
9	ANODE #2, G_2	320	200K*
10	DJ_2	340	430K*
11	DJ_1	340	440K*
12	NC		NC
13	NC		NC
14	H		1.3 MEG
CAP		400	

DO NOT MEASURE

6.3 V. AC BETWEEN PINS 1 & 14.

WARNING 1700 VOLTS FROM GROUND.

DO NOT MEASURE

V120 6AS6				
PIN		VOLTS D/F	VOLTS CAL	RES.
1	G_1	-20	54	120 K
2	K	1.0	0	2 K
3	H	6.2		.2
4	H	GR		0
5	P	110		500 K
6	G_2	110		470K*
7	G_3	-1.85	-2.65	25K

MEASURE WITH VTVM

V110 2C51			
PIN		VOLTS	RES.
1	H	GR	0
2	K_{T_1}	7.5	47K CCW 7 K CW
3	G_{T_1}	11	2.2 MEG
4	P_{T_1}	170	16 K
5	NC		1.2 MEG
6	P_{T_2}	3	0.0 CCW 2.5K CW
7	G_{T_2}	3.3	0.0 CCW 2.5K CW
8	K_{T_2}	7.5	1.2 MEG
9	H	6.1 AC	.2

POT. R151

MEASURE WITH VTVM

V108 2C51			
PIN		VOLTS	RES.
1	H	6.1	.2
2	K_{T_1}	-3.5	200 K
3	G_{T_1}	-10	300 K
4	P_{T_1}	-10	300 K
5	NC		250K
6	P_{T_2}	-11	380K
7	G_{T_2}	-82	1.2MEG
8	K_{T_2}	-78	220K CCW 220K CW
9	H	GR	0.0

POT. R132

V124 2C51				
PIN		VOLTS D/F	VOLTS CAL	RES.
1	H	SEE NOTE 1		∞
2	K_{T_1}	117		460K*
3	G_{T_1}	112		500K
4	P_{T_1}	320	300	430K*
5	NC			NC
6	P_{T_2}	320	300	430K
7	G_{T_2}	112		500K
8	K_{T_2}	117		460K*
9	H	SEE NOTE 1		∞

MEASURE WITH VTVM

V107 6AS6			
PIN		VOLTS	RES.
1	G_1	0	0.0
2	K	1.8	270
3	H	GR	0.0
4	H	6.3AC	0.25
5	P	110	60K
6	G_2	110	60K
7	G_3	1.8	270

V122 2C51			
PIN		VOLTS	RES.
1	H	SEE NOTE 1	500 K
2	K_{T_1}	146	500 K
3	G_{T_1}	136	650K*
4	P_{T_1}	440	350K*
5	NC		NC
6	P_{T_2}	440	350K*
7	G_{T_2}	130	690K*
8	K_{T_2}	144	500 K
9	H	SEE NOTE 1	500 K

R238 1H-4B		
PIN	VOLTS	RES.
1 NC		NC
2	5AC	4.2
3 NC		NC
4 NC		NC
5 NC		NC
6 NC		NC
7	12.5AC	1.2
8 NC		NC

V126 5651			
PIN		VOLTS	RES.
1	P	GR	0.0
2	K	85	230K
3	NC		NC
4	K	85	230K
5	P	GR	0.0
6	NC		NC
7	K	85	230 K

V125 5651			
PIN		VOLTS	RES.
1	P	85	220K
2	K	170	360K
3	NC		NC
4	K	170	360K
5	P	85	220K
6	NC		NC
7	K	170	360K

V106 6AS6			
PIN		VOLTS	RES.
1	G_1	-7	1 MEG.
2	K	0	0.0
3	H	6.3AC	0.25
4	H	GR	0.0
5	P	190	60K
6	G_2	190	60K
7	G_3	0	0.0

MEASURE WITH VTVM

V114 2C51			
PIN		VOLTS	RES.
1	H	6.3AC	0.2
2	K_{T_1}	-9	100K
3	G_{T_1}	-20	140K
		-10	380 K
4	P_{T_1}	195	9K
5	NC		250K
6	P_{T_2}		NC
7	G_{T_2}		NC
8	K_{T_2}		NC
9	H	GR	0.0

S101 "CAL"
S101 "D/F"

V105 6AS6			
PIN		VOLTS	RES.
1	G_1	-7	1 MEG.
2	K	0	0.0
3	H	6.3AC	0.25
4	H	GR	0.0
5	P	190	60K
6	G_2	190	60K
7	G_3	0	0.0

NOTES-

1.- ISOLATED FILAMENTS- 6.3 V. AC BETWEEN PINS 1 & 9.

2. ISOLATED FILAMENTS- 6.3 V. AC BETWEEN PINS 2 & 6.

3. ALL VOLTAGE MEASUREMENTS TAKEN WITH 20,000 Ω/VOLT DC, 1,000 Ω/VOLT AC METER UNLESS OTHERWISE STATED. AC TO CHASSIS.

4. ALL VOLTAGES DC UNLESS OTHERWISE STATED.

5. ALL RESISTANCE READINGS TAKEN TO CHASSIS.

6. MEASUREMENTS MARKED "VTVM" TAKEN WITH ELECTRONIC VOLTMETER.

* READING TAKEN WHEN CAPACITOR IS FULLY CHARGED.

V128 1B3GT			
PIN		VOLTS	RES.
1			
2	H	0	0
3			
4			
5			
6			
7	H	1.0AC	0
8			
PLATE CAP		2100AC	1.5MEG

DO NOT MEASURE

V115 VR150			
PIN		VOLTS	RES.
1			NC
2	K	GR	0.0
3			NC
4			NC
5	P	110	470K*
6			NC
7			NC
8			NC

V119 6AS6				
PIN		VOLTS D/F	VOLTS CAL	RES.
1	G_1	-2.4	-6.4	100K
2	K	1.0	0	2.3K
3	H	6.2AC		.2
4	H	GR		0
5	P	110		500K
6	G_2	110		450K*
7	G_3	-1.85	-2.65	25K

V121 2C51			
PIN		VOLTS	RES.
1	H	GR	0.0
2	K_{T_1}	73	420K*
3	G_{T_1}	70	290K
4	P_{T_1}	137	680K*
5	NC		NC
6	P_{T_2}	135	680K*
7	G_{T_2}	70	500K
8	K_{T_2}	73	470K*
9	H	6.3AC	0.2

V109 2C51			
PIN		VOLTS	RES.
1	H	GR	0.0
2	K_{T_1}	1.3	1.2K
3	G_{T_1}	0	1MEG CCW 2 MEG CW
4	P_{T_1}	75	140K
5	NC		NC
6	P_{T_2}	200	52K
7	G_{T_2}	0	330K
8	K_{T_2}	3	470
S	H	6.3AC	0.25

V102 6AS6			
PIN		VOLTS	RES.
1	G_1	-11	22K
2	K	0	0.0
3	H	5AC	10.0
4	H	GR	0.0
5	P	120	66K
6	G_2	120	66K
7	G_3	120	66K

V118 6AS6				
PIN		VOLTS D/F	VOLTS CAL	RES.
1	G_1	-2.4	-6.6	100K
2	K	1.0	0	2.4K
3	H	6.2AC		.2
4	H	GR		0
5	P	110		500K
6	G_2	110		450K*
7	G_3	-1.8	-2.6	25K

V116 VR75			
PIN		VOLTS	RES.
1			1K
2	K	GR	0.0
3			∞
4			380K
5	P	75	∞
6			120K
7			NC
8			NC

V111 2C51			
PIN		VOLTS	RES.
1	H	GR	0.0
2	K_{T_1}	1.4	1.3 K
3	G_{T_1}	0.45	1.8K
4	P_{T_1}	75	130K
5	NC		NC
6	P_{T_2}	165	850K*
7	G_{T_2}	70	38K
8	K_{T_2}	72	430K*
9	H	6.2AC	.2

MEASURE WITH VTVM

V113 5R4GY			
PIN		VOLTS	RES.
1	NC		NC
2	H	440	350K
3	NC		NC
4	P_2	440AC	110
5	NC		NC
6	P_1	440AC	110
7	NC		NC
8	H	440	300K*

V117 6AS6				
PIN		VOLTS D/F	VOLTS CAL	RES.
1	G_1	-2.0	-6.8	110K
2	K	1.0	0	1.8K
3	H	6.2AC		0.2
4	H	GR		0.0
5	P	110		500K
6	G_2	110		460K*
7	G_3	-1.8	-2.6	23K

V112 6Y6G			
PIN		VOLTS	RES.
1	NC		100K
2	H	SEE NOTE 2	360K
3	P	440	280K*
4	G_2	440	280K*
5	G_1	170	580K
6	NC		40K
7	H	SEE NOTE 2	400K
8	K	205	120K

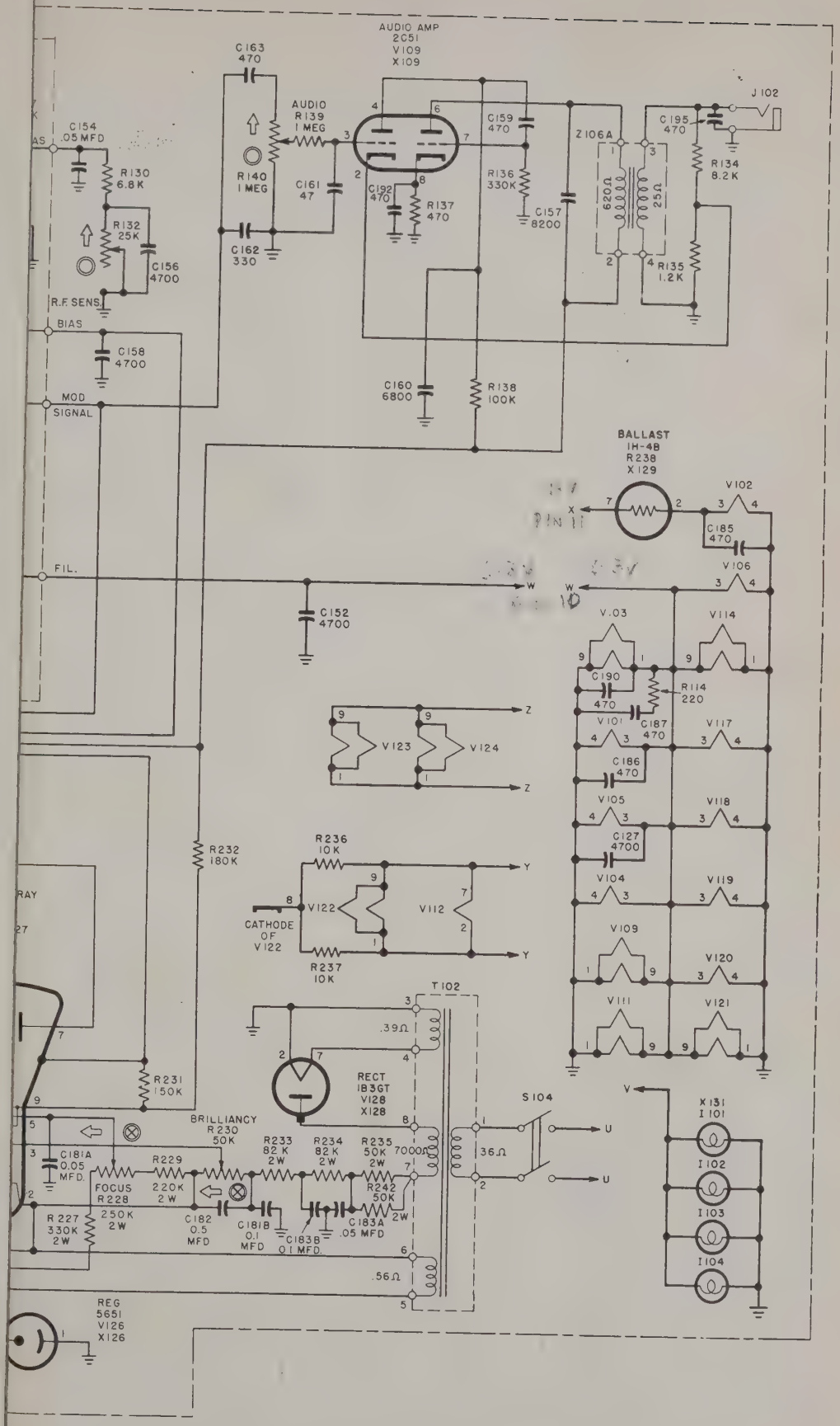
V123 2C51				
PIN		VOLTS D/F	VOLTS CAL	RES.
1	H	SEE NOTE 1		∞
2	K_{T_1}	117		460K*
3	G_{T_1}	112		500K
4	P_{T_1}	320	300	430K*
5	NC			NC
6	P_{T_2}	320	300	430K*
7	G_{T_2}	112		500K
8	K_{T_2}	117		460K*
9	H	SEE NOTE 1		∞

V104 6AS6			
PIN		VOLTS	RES.
1	G_1	-7	1 MEG.
2	K	0	0.0
3	H	6.3AC	0.25
4	H	GR	0.0
5	P	190	60K
6	G_2	190	60K
7	G_3	0	0.0

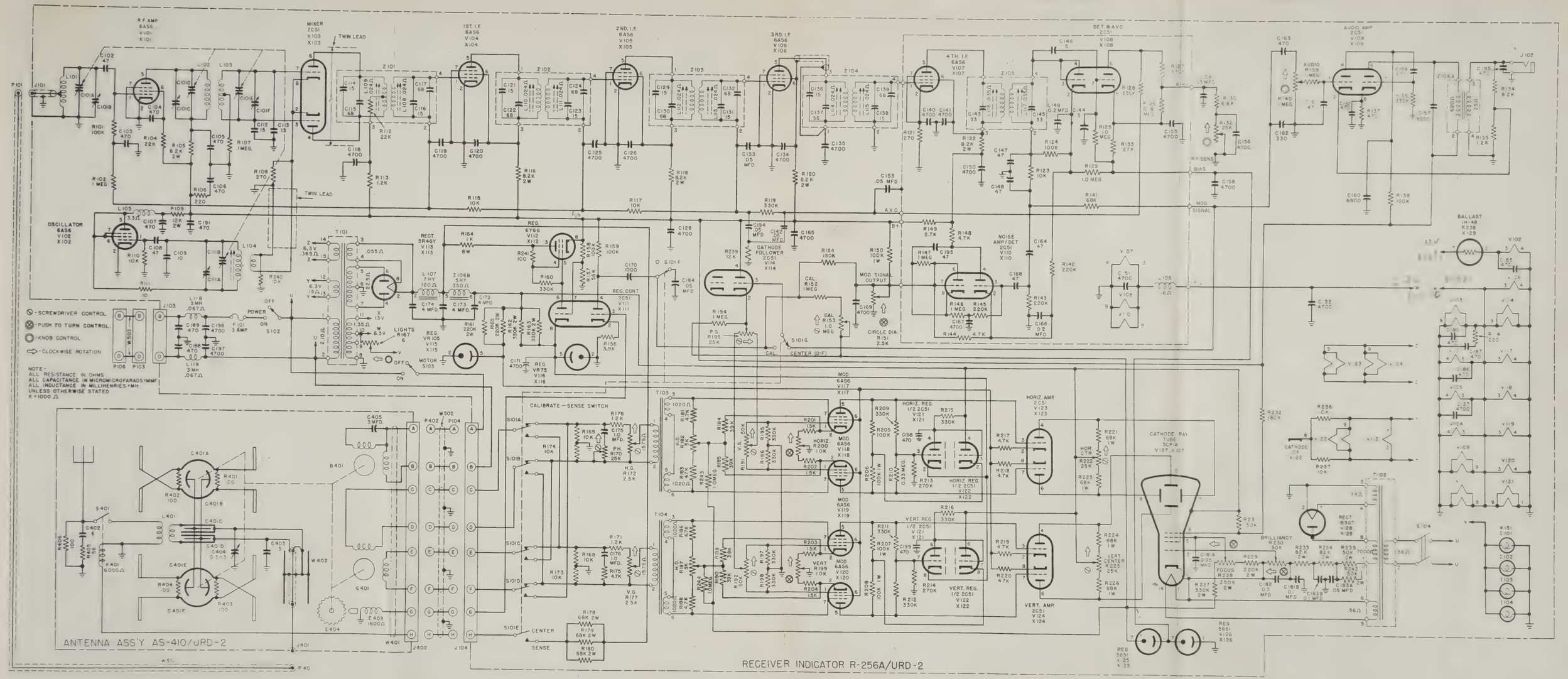
V103 2C51			
PIN		VOLTS	RES.
1	H	GR	0.0
2	K_{T_1}	0	0.0
3	G_{T_1}	-10.5	100K
4	P_{T_1}	66	63K
5	NC		0.0
6	P_{T_2}	66	63K
7	G_{T_2}	-10.5	100K
8	K_{T_2}	0	0.0
9	H	6.3AC	0.25

V101 6AS6			
PIN		VOLTS	RES.
1	G_1	0	2 MEG.
2	K	GR	0.0
3	H	6.3AC	0.25
4	H	GR	0.0
5	P	165	55K
6	G_2	160	63K
7	G_3	GR	0.0

Figure 7-15. Type R-256A/URD-2 Receiver-Indicator, Tube Socket Voltage and Resistance Chart



Radio Direction Finder Set AN/URD–2A, Schematic Diagram


RF AMP 6AS6 V101 X101
MIXER 2C51 V103 X103
1ST. I.F 6AS6 V104 X104
2ND. I.F 6AS6 V105 X105
3RD. I.F 6AS6 V106 X106
4TH. I.F 6AS6 V107 X107
DET. & A.V.C. 2C51 V108 X108
AUDIO AMP 2C51 V109 X109
OSCILLATOR 6AS6 V102 X102
REG. 6Y6G V112 X112
RECT. 5R4GY V113 X113
REG. VR 105 V115 X115
REG. VR 75 V116 X116
REG. CONT. 2C51 V111 X111
CATHODE FOLLOWER 2C51 V114 X114
NOISE AMP/DET 2C51 V110 X110
MOD 6AS6 V117 X117
MOD 6AS6 V118 X118
MOD 6AS6 V119 X119
MOD 6AS6 V120 X120
HORIZ. AMP 2C51 V123 X123
HORIZ. REG. 1/2 2C51 V121 X121
HORIZ. REG. 1/2 2C51 V122 X122
VERT. AMP 2C51 V124 X124
VERT. REG. 1/2 2C51 V121 X121
VERT. REG. 1/2 2C51 V122 X122
CATHODE RAY TUBE 5CP1A V127 X127
REG 5651 V126 X126
REG 5651 V 25 X 25
BALLAST IH-48 R238 X129
V102
V103
V104
V105
V106
V107
V108
V109
V110
V111
V112
V113
V114
V115
V116
V117
V118
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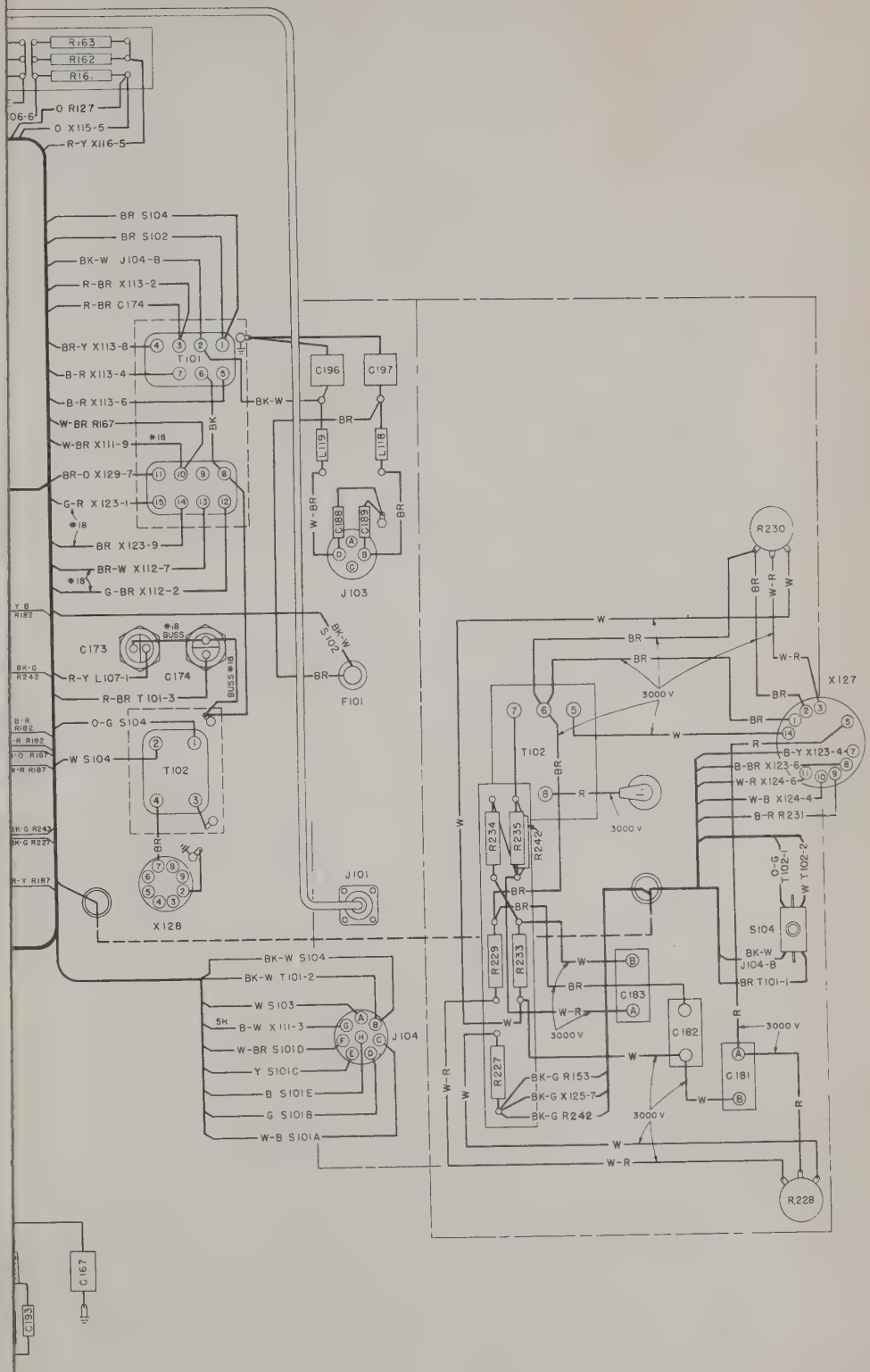
V161
V162



–17. Radio Receiver R–256A/URD–2, Wiring Diagram

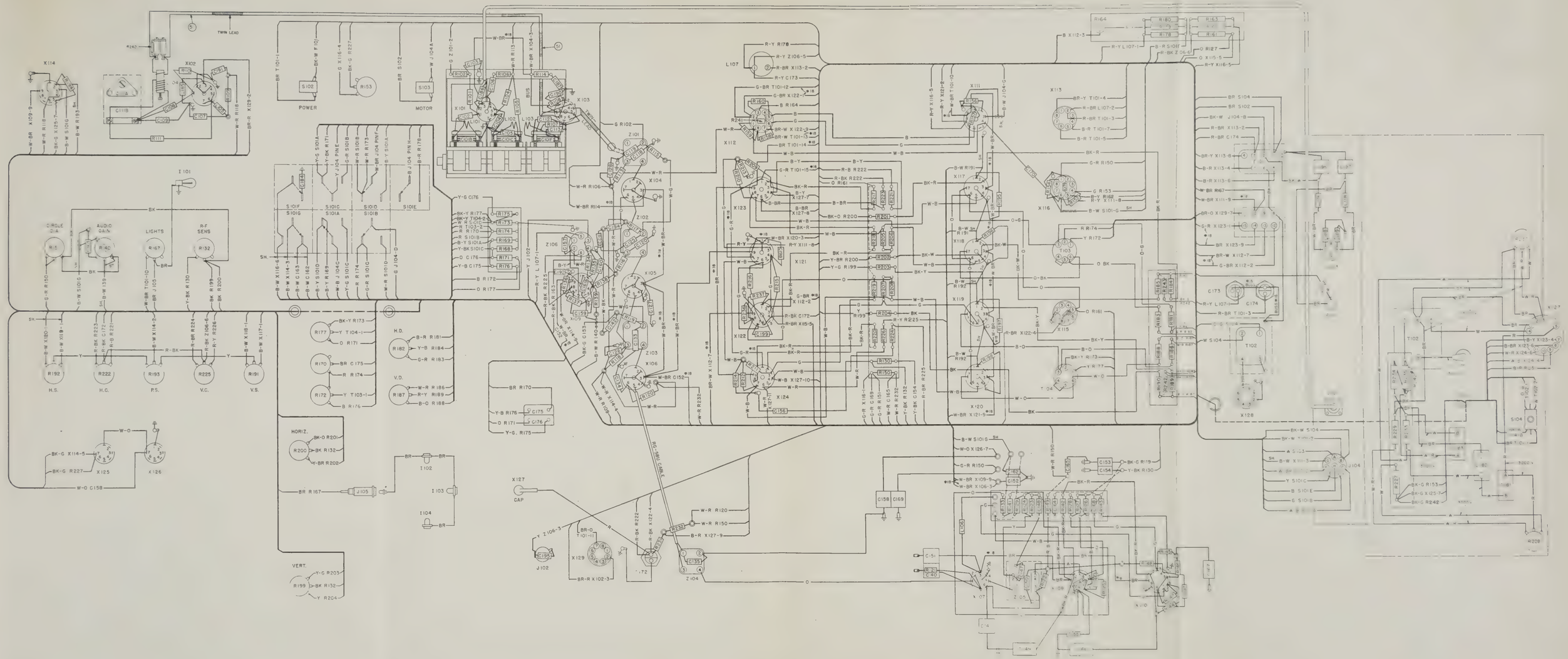


Figure 7-17. Radio Receiver R-256A/URD-2, Wiring Diagram

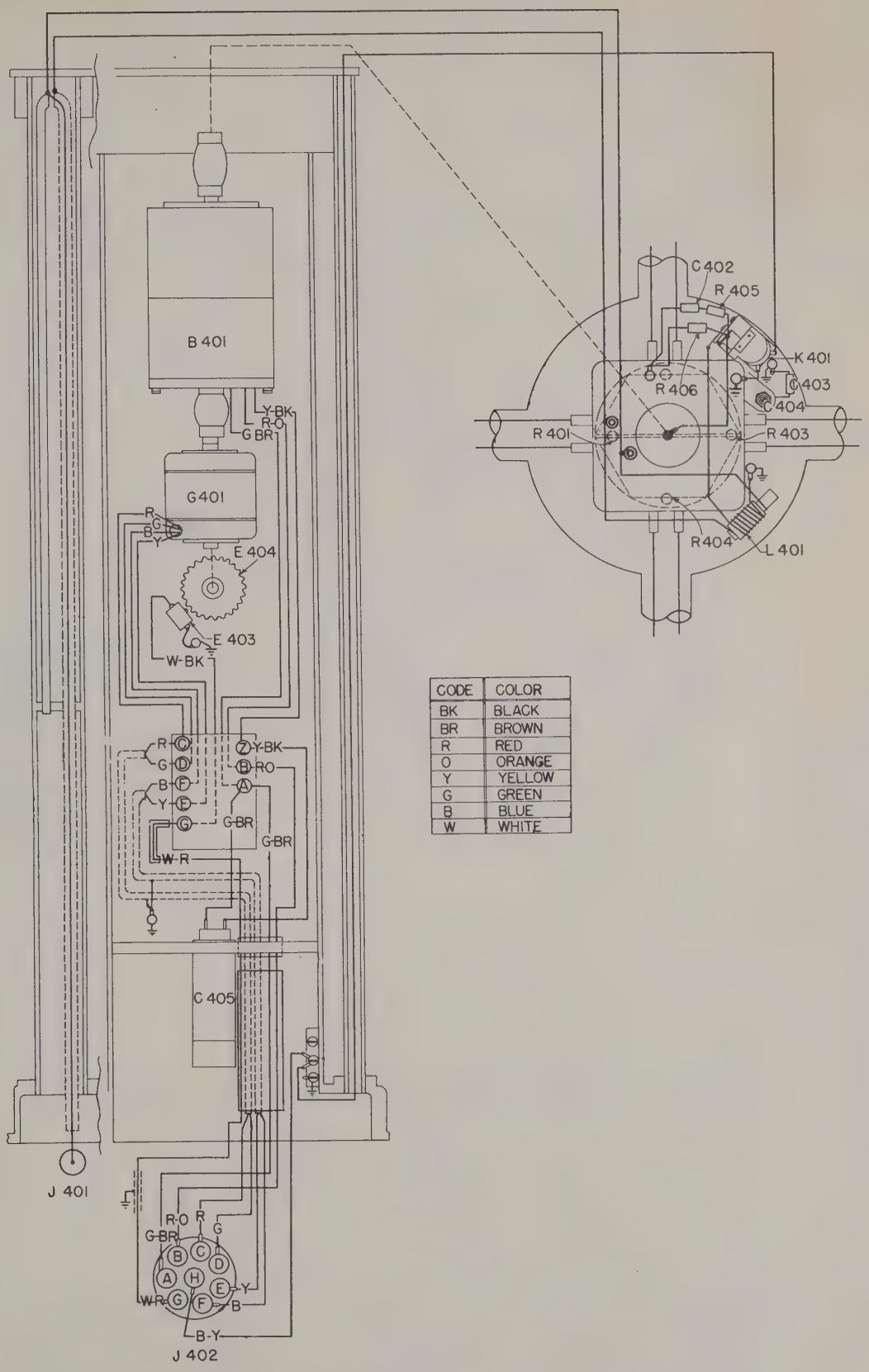


Figure 7–18. Antenna and Goniometer Assembly AS–410/URD–2, Wiring Diagram

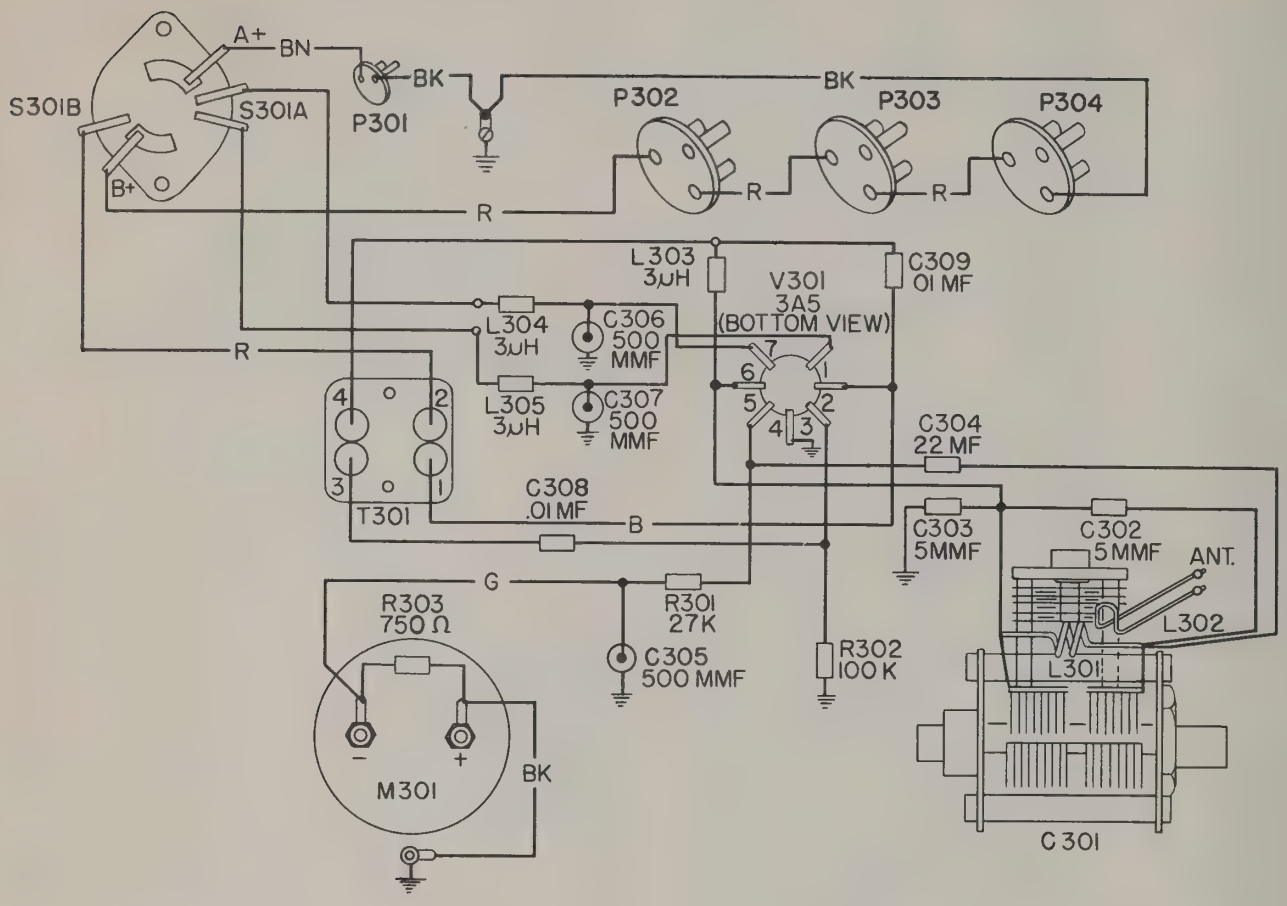


Figure 7–19. Target Transmitter T–207A/URD–2, Wiring Diagram

SECTION 8
PARTS LISTS

TABLE 8–1. WEIGHTS AND DIMENSIONS OF REPAIR PARTS BOXES

EQUIPMENT REPAIR PARTS					
REPAIR PARTS BOX	OVERALL DIMENSIONS			VOLUME (cu. in.)	WEIGHT
	HEIGHT	WIDTH	DEPTH		
#1	9	12	36	3388	83 lbs.

TABLE 8–2. SHIPPING WEIGHTS AND DIMENSIONS OF REPAIR PARTS BOXES

EQUIPMENT REPAIR PARTS						
SHIPPING BOX NUMBER	REPAIR PARTS BOX	OVERALL DIMENSIONS			VOLUME (cu. in.)	WEIGHT
		HEIGHT	WIDTH	DEPTH		
#1	#1	9	12	36	3388	83 lbs.

TABLE 8–3. LIST OF MAJOR UNITS

SYMBOL GROUP	QUANTITY	NAME OF MAJOR UNIT	Army-Navy Type DESIGNATION
101 – 300	1	RADIO RECEIVER	R–256A/URD–2
301 – 400	1	RADIO TRANSMITTER	T–207A/URD–2
401 – 500	1	ANTENNA ASSEMBLY	AS–410/URD–2
501 – 600	1	POWER CABLE ASSEMBLY	(—62445)
	1	POWER CABLE ASSEMBLY	(—62446)
	1	CORD	CG–92A/U

TABLE 8–4. TABLE OF REPLACEABLE PARTS

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
A101		HOUSING: for dial drive; c/o housing, brg pl, mtg bkt and idler shaft; cast bronze SAE #62; irregular shape; 6.27" h x 4.72" wd x 2.85" d o/a; two #10–24 tapped holes spaced on 4.160" mtg/c; same as part/dwg #L203545–1 except for modification to permit addition of spring to eliminate play in shaft. Bendix part/dwg L203545–2	Dial drive
A102	N16–V–300651–726 3300–028700015	VISOR: CR tube light shield; c/o shield support Bendix #N208172–1 and G. W. Bollman Co light shield; 10–13/16" lg x 7–5/64" diam o/a at large end; clamp mtg. Bendix part/dwg N208171–1	For viewing CRT
A301	2A3942–2 N16–T–802001–108 1700–205526010	TRIPOD: Navy Type #(–10610) for transmitter; studio stand type; 59" lg; wood legs; threaded hd 3"–12 thd; incl protective cap; Navy gray finish, K&E Co. Similar to 5174. Bendix part/dwg L222507–4	For supporting T–207A/URD–2
A401	2A3393A.1–100 N16–S–850281–143 1700–205297146	SUPPORT, antenna: elements; aluminum casting ocean gray finish; 4 cylindrical arms extending 9–1/2" from ctr and spaced 90 deg apart; cross-arms form 19" sq x 4–7/8" thk o/a mtd by fl w/six #10–24 thd holes in 2 sets of 3 spaced 55 deg apart on 4–1/4" mtg/diam. Bendix part/dwg OR203414–1	Antenna elements support
A401–1	N16–S–850281–146	Listed for reference only. SUPPORT, antenna: elements; c/o cross arm, cover plates; gaskets and mtg hdw; 4 cylindrical arms extending 9–1/2" from ctr and spaced 90 deg apart; cross arms form 19" sq x 4–7/8" thk o/a; mtd by fl w/six #10–24 thd holes in 2 sets of 3 spaced 55 deg apart on 4–1/4" mtg/diam. Bendix part/dwg OR203414–2	Antenna elements support
A402	2Z5091–87 N16–M–58382–6701 1700–291703151	MOUNTING, antenna: for ant sub-assembly; aluminum casting; 6–1/2" max OD x 3–3/8" min OD x 27.320" lg; mtd 1 end by fl 4/68" OD w/ six 0.221" holes in 2 sets of 3 spaced 55 deg apart on 4–1/4" mtg diam, mtd other end by fl 6–1/2" OD w/ six 0.28" diam holes spaced 60 deg apart on 6" mtg diam. Bendix part/dwg #N203417–1	For antenna parts
A403	2Z3351–208 N16–H–800001–193 1700–287720662	HOUSING: aluminum casting; 5–11/16" lg x 4.687" wd x 3–1/8" h w/ protrusion 1–3/4" OD x 1" h from face of casting w/ 1–1/2"–12 inner inner thd; 2 sets of three 0.177" diam holes spaced 50 deg apart on 4–1/4" mtg diam, 80 deg between sets. Bendix part/dwg #N228321	Housing cover
A404	2A326.2–10 N16–B–150221–130 1700–203131912	BASE, antenna: aluminum casting; 6–1/2" B x 3.76" h w/ 1–15/16" bore 3.32" d; six 0.281" diam holes spaced 60 deg on 6" mtg diam, four 5/16"–18 tapped holes in hub for mtg to mast. Bendix part/dwg #N228471	Support for attaching to mast
A405	2A2060–6 N16–M–150299–875 1700–204024684	MAST, antenna supports: Navy Type #(–10662); c/o tube and guy plate; aluminum, ocean gray, 20 ft lg o/a; x 1.900" OD, 1.610" ID, guy plate 3–3/4" OD; four 1/4" diam holes 90 deg apart on 3" diam for attaching guy wires. Bendix part/dwg #C202331–2	For supporting AS–410/URD–2

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
B401	3H3000–173 N17–M–54490–2333 1700–373734276	MOTOR, AC: Navy Type #(–212032); capacitor; 1/100 hp, 1800 rpm; open frame; 40° C temp rise; shaft 0.430" lg x 5/16" diam ea end 5–3/4" lg x 3–1/8" max OD; 115v AC, 60 cyc, single ph 320 ma, 85% pf; two #8–32 holes on 2–3/4" mtg/c one end, other end w/ four 0.196" diam holes spaced 90 deg apart on 2–3/4" mtg diam; Elec Indicator #B–1569D Issue D. Bendix part/dwg #N222829–1	Goniometer driving
C101 A, B, C	3D9034VE7–1 N16–C–63671–2868 3330–313343861	CAPACITOR, variable: Navy Type #(–484950); air dielectric 3 gang, ea gang dual sect plate meshing type; 0 to 34.7 mmf ea sect modified SLF characteristic; air gap 0.0145"; 5.18" lg x 2" wd x 3–1/2" h o/a excluding shaft, shaft 3/8" diam x 0.35" lg; extension shaft adj; 13 brass plates per sect; 180 deg counterclockwise rotation; ceramic ins; three #8–32 thd tapped holes irregularly spaced on 1–1/2 mtg/diam; w/3 neutralizing type variable capacitors mtd on top; RCC #230–51. Bendix part/dwg #N219052	RF gang, ant tuning V101
C102	3D9047–23 N16–C–16541–7014 3330–313430240	CAPACITOR, fixed: ceramic; JAN type CC21SL470K; 47 mmf, p/m 10%; neg temp coef 330 (tol + 500) mmf/mf/° C; 500 vdcw; 1/4" diam x 9/16" lg; 2 axial wire lead term; ceramic ins; temp compensating type spec JAN–C–20A.	Gr V101
C103	3D9470–38 N16–C–18179–8022 3330–314430224	CAPACITOR, fixed: Navy Type #(–484833–20); ceramic; 470 mmf p/m 20%; var temp coef; 500 vdcw; 1/4" diam x 9/16" lg; 2 axial wire leads; phenolic ins; Erie Style K. Bendix part/dwg #C65524–471	Gr bias V101
C104		Same as C103.	Scr byp V101
C105		Same as C103.	Pl byp
C106		Same as C103.	Pl V101
C107		Same as C103.	Pl byp V102
C108		Same as C102.	Gr coup V102
C109	3D9010–63 N16–C–15915–9167 3330–313004520	CAPACITOR, fixed: ceramic; JAN type CC21CH100D; 10 mmf, p/m 0.5 mmf; zero temp coef (tol + 60) mmf/mf/°C; 500 vdcw; 1/4" diam x 9/16" lg; 2 axial wire lead term; ceramic ins; temp compensating type; spec JAN–C–20A.	Excitation control gr V102
C110		Not Used.	
C111	3D9034VE7 N16–C–62299–4354 3330–313343860	CAPACITOR, variable: Navy Type #(–484949); Air dielectric; dual sect plate meshing type; 0 to 43.7 mmf ea sect; SLF characteristic; air gap 0.0145"; 2–1/4" lg, excluding shaft x 2" w x 2–3/4" h o/a; shaft 0.310" diam one end x 0.62" lg; shaft other end 0.35" lg x 3/8" min diam; 13 brass plates per sect; 180 deg counterclockwise rotation; ceramic ins; solder lug term; three #8–32 thd tapped mtg holes irregularly spaced on 1–1/2" mtg/diam; w/ neutralizing type variable capacitor mtd on top; RCC #230–1. Bendix part/dwg #L219051	C111A osc trim C111B osc gang
C112	3D9015–130 N16–C–15998–6081 3330–313090668	CAPACITOR, fixed: ceramic; JAN type CC21UK150K; 15 mmf, p/m 10%; neg temp coef 750 (tol + 250) mmf/mf/°C; 500 vdcw; 1/4" diam x 9/16" lg; 2 axial wire lead term; ceramic ins; temp compensating type; spec JAN–C–20A.	Gr bal V103
C113		Same as C112.	Gr bal V103
C114	3D9015–119 N16–C–15989–1581 3330–313090657	CAPACITOR, fixed: ceramic; JAN type CC21UK150J; 15 mmf, p/m 5%; neg temp coef 750 (tol + 250) mmf/mf/°C; 500 vdcw; 1/4" diam x 9/16" lg; 2 axial wire lead term; ceramic ins; temp compensating type; spec JAN–C–20A.	Temp cond p/o pri Z101

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS — SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C115	3K2062033 N16–C–27993–9321 3330–376040000	CAPACITOR, fixed: mica; JAN type CM20C680G; 68 mmf, p/m 2%; 500 vdcw; temp coef ltr C; 51/64" lg x 15/32" wd x 7/32" thk; molded bakelite case; 2 axial wire leads; spec JAN–C–5.	Trimmer, p/o pri Z101
C116		Same as C114.	Temp control p/o secd Z101
C117		Same as C115.	Trimmer p/o secd Z101
C118	3K3547224 N16–C–32651–9288 3330–376151200	CAPACITOR, fixed: mica; JAN type CM35B472M; 4700 mmf, p/m 20%; 500 vdcw; temp coef ltr B; 53/64" lg x 53/64" wd x 11/32" thk; molded bakelite case; 2 axial wire leads; spec JAN–C–5.	Byp pri Z101
C119		Same as C118.	Byp secd Z101
C120		Same as C118.	Byp pri Z102
C121		Same as C114.	Temp control p/o pri Z102
C122		Same as C115.	Trimmer, p/o pri Z102
C123		Same as C114.	Temp control p/o secd Z102
C124		Same as C115.	Trimmer, p/o secd Z102
C125		Same as C118.	Byp secd Z102
C126		Same as C118.	Byp pri Z103
C127		Same as C118.	Fil byp V105
C128		Same as C118.	Byp pl V105
C129		Same as C114.	Temp control p/o pri Z103
C130		Same as C115.	Trimmer, p/o pri Z103
C131		Same as C114.	Temp control p/o secd Z103
C132		Same as C115.	Trimmer, p/o secd Z103
C133	3DA200–63 N16–C–46150–9760 3330–316562528	CAPACITOR, fixed: paper; JAN type CN43E204K; 200,000 mmf; p/m 10%; 120 vdcw; molded bakelite case; 1–15/32" lg x 49/64" wd x 13/32" thk; 2 axial wire lead term, no int gnd connections; spec JAN–C–91.	Byp secd Z103
C134		Same as C118.	Byp control gr V106
C135		Same as C118.	Pyp pri Z104
C136		Same as C114.	Temp control p/o pri Z104
C137	3K2056033 N16–C–27756–5721 3330–376039200	CAPACITOR, fixed: mica; JAN type CM20C560G; 56 mmf, p/m 2%; 500 vdcw; temp coef ltr C; 51/64" lg x 15/32" wd x 7/32" thk; molded bakelite case; 2 axial wire leads; spec JAN–C–5.	Padder pri Z104
C138		Same as C114.	Temp control p/o secd Z104
C139		Same as C115.	Trimmer, p/o secd Z104
C140		Same as C118.	Cath byp V107
C141		Same as C118.	Byp pri Z105

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS: SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C142	3DA50–172 N16–C–44249–4760 3330–316163255	CAPACITOR, fixed: Navy type #(–484093–10); paper; 50,000 mmf p/m 10%; 120 vdcw; molded phenolic case; 13/16" lg x 13/16" wd x 19/64" thk; oil impr; 2 axial wire lead term; Tobe #DPO5K120. Bendix part/dwg #C220030–7	AVC filter byp
C143	3K2033032 N16–C–27181–4401 3330–376024210	CAPACITOR, fixed: mica; JAN type CM20C330J; 33 mmf, p/m 5%; 500 vdcw; temp coef ltr C; 51/64" lg x 15/32" wd x 7/32" thk; molded bakelite case; 2 axial wire leads; spec JAN–C–5.	Padder p/o pri Z105
C144	3D9005–85 N16–C–15629–2694 3330–312860687	CAPACITOR, fixed: ceramic; JAN type CC21UK050D; 5 mmf, p/m 0.5 mmf; neg temp coef 750 (tol + 250) mmf/mf/°C; 500 vdcw; 1/4" diam x 9/16" lg; 2 axial wire lead term; ceramic ins; temp compensating type spec JAN–C–20A.	AVC div byp
C145		Same as C143.	Padder p/o secd Z105
C146		Same as C144.	AVC coup p/o pl V107
C147		Same as C102.	Audio byp gr V110
C148		Same as C102.	Audio byp gr V110
C149		Same as C133.	Cath byp V108
C150		Same as C118.	Byp pri V105
C151		Same as C118.	Fil byp V108
C152		Same as C118.	Fil byp V108
C153		Same as C142.	Time constant pl V108
C154		Same as C142.	Pl byp V108
C155		Same as C118.	Cath byp V108
C156		Same as C118.	Byp cath V108
C157	3K3582222 N16–C–33274–5543 3330–376158450	CAPACITOR, fixed: mica; JAN type CM35B822J; 8200 mmf, p/m 5%; 300 vdcw; temp coef ltr B; 53/64" lg x 53/64" wd x 11/32" thk; molded bakelite case; 2 axial wire leads; spec JAN–C–5.	Pl byp V109
C158		Same as C118.	Byp cath V108
C159		Same as C103.	Pl V109
C160	3K3568211 N16–C–33068–5818 3330–376155520	CAPACITOR, fixed: mica; JAN type CM35A682K; 6800 mmf, p/m 10%; 300 vdcw; temp coef ltr A; 53/64" lg x 53/64" wd x 11/32" thk; molded bakelite case; 2 axial wire leads; spec JAN–C–5.	Pl byp V109
C161		Same as C102.	Audio filter V109
C162	3D9330–24 N16–C–17923–8022 3330–314328093	CAPACITOR, fixed: Navy Type #(–484952–20); ceramic; 330 mmf p/m 20%; var temp coef; 500 vdcw; 1/4" diam x 9/16" lg; 2 axial wire leads; phenolic ins; Erie Style K. Bendix part/dwg #C65524–331	Audio filter V109
C163		Same as C103.	Gr bias V109
C164		Same as C102.	Audio coup to gr V110
C165		Same as C118.	Byp pri Z104
C166		Same as C133.	Byp audio gr V110
C167		Same as C118.	Cath byp V110
C168		Same as C102.	Audio coup to gr V110
C169		Same as C118.	Byp gr V110

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C170	3K3510224 N16–C–31095–6688 3330–376143494	CAPACITOR, fixed: 1000 mmf, p/m 20%; 500 vdcw; temp coef ltr "B"; 53/64" lg x 53/64" wd x 11/32" thk; molded bakelite; 2 axial wire leads; spec JAN–C–5. JAN type CM35B120M	Coup pl V111
C171		Same as C118.	Byp pl V116
C172	3DB4–282 N16–C–49981–9993 3330–317643024	CAPACITOR, fixed: paper; JAN type CP41B1DF405V; 1 sect; 4 mf, + 20%–10%; 600 vdcw; HS metal case; 4–1/2" lg x 1–1/2" diam; 2 solder lug term on bottom; no int gnd connections; 3/4–16 thd x 1/2" lg bushing on bottom for mtg; spec JAN–C–25.	B + filter
C173		Same as C172.	B + filter
C174		Same as C172.	B + filter
C175	3DB1–195 N16–C–48808–9150 3330–316958819	CAPACITOR, fixed: paper; JAN type CP53B1EB105K; 1 sect; 1 mf, p/m 10%; 1100 vdcw; HS metal case; 1–3/16" lg x 1" wd x 7/8" h; 2 solder lug term on side; no int gnd connections; two 3/16" diam holes on 2–1/8" mtg/c; spec JAN–C–25.	Phasing, pri T103
C176		Same as C175.	Phasing, pri T104
C177		Not Used.	
C178		Not Used.	
C179		Not Used.	
C180		Not Used.	
C181 A, B	3DA100–735 N16–C–52992–7087 3330–316777660	CAPACITOR, fixed: Navy Type #(–483953–10); paper; 2 sect; 50,000 and 100,000 mmf p/m 10%; 2,000 vdcw; HS metal case; 1–13/16" lg x 1–1/16" wd x 2–1/4" h; oil impr and filled; 2 solder glass ins term 1–7/16" h spaced 3/4" c to c on top; 2 sect int gnd; requires mtg bkt. Bendix part/dwg #C220005	(A) Focus anode byp V127 (B) HV filter
C182	N16–C–47335–6210	CAPACITOR, fixed: papers; JAN type CP54B1EE504X; 1 sect; 500,000 mmf, + 40%–15%; 400 vdcw; HS metal case; 1–13/16" lg x 1" wd x 7/8" h; 2 solder lug term on top; no int gnd connections; two 3/16" diam holes on 2–1/8" mtg/c; spec JAN–C–25.	Cath byp V127
C183 A, B		Same as C181 A, B.	HV filter pl V128
C184		Same as C142.	Byp pl V111
C185		Same as C103.	Byp fil V102
C186		Same as C103.	Byp fil V101
C187		Same as C103.	Byp fil V103
C188		Same as C103.	Filter byp pri T101
C189		Same as C103.	Filter byp pri T101
C190		Same as C103.	Byp fil V103
C191		Same as C103.	Pl V101
C192		Same as C103.	Cath byp V109
C193		Same as C102.	Audio coup pl V110
C194		Same as C142.	AVC filter
C195		Same as C103.	RF filter J102
C196		Same as C118.	Filter byp pri T101
C197		Same as C118.	Filter byp pri T101
C198		Same as C103.	Pl byp V121 (horiz)

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS: SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
C199		Same as C103.	Pl byp V121 (vert)
C301		Same as C111.	Tuning
C302	3D9005–116 N16–C–25102–6281 3330–312860718	CAPACITOR, fixed: mica; 5 mmf, p/m 10%; 500 vdcw; character letter C; 0.52″ lg x 0.30″ wd x 0.22″ thk; molded low loss bakelite case; 2 axial wire lead term; Electro-Motive #CM150050K. Bendix #OC220133–41	Trimmer tuning ckt
C303		Same as C302.	Byp pl V301
C304	3D9022–49 N16–C–26843–5550 3330–313174267	CAPACITOR, fixed: mica; 22 mmf, p/m 10%; 500 vdcw; character letter C; 0.52″ lg x 0.30″ wd x 0.22″ thk; molded low loss bakelite case; 2 axial wire lead term; Electro-Motive #CM15C220K. Bendix #C220133–47	Gr coup V301
C305	3D9500–189 N16–C–30172–4381 3330–314693459	CAPACITOR, fixed: NT–484834–E20; mica; 500 mmf, p/m 20%; 500 vdcw; temp coef E; 0.447″ diam x 13/32″ h o/a; brass, silver pl; 2 solder lug term; #3–48 thd hole 7/64″ min depth; Erie #370–FA. Bendix part/dwg #C220009	Gr byp V301
C306		Same as C305.	Fil byp V301
C307		Same as C305.	Fil byp V301
C308	N16–C–42729–9769 3330–057250100	CAPACITOR, fixed: paper dielectric; 10,000 mmf, p/m 10%; 200 vdcw; molded phenolic case; 21/64″ thk x 53/64″ sq; oil imer; 2 axial wire leads; no int gnd connections; term mtd; Tobe #DP–01–K–200. Bendix part/dwg #OC220030–18	Coup gr V301
C309		Same as C308.	Pl coup V301
C401 A, B, C, D, E, F	3D9095V–5 N16–C–63458–8201 3330–313624041	CAPACITOR, variable: air dielectric; plate meshing type; 4 sect; capacity ea sect 12 mmf min, 65 mmf max; capacity of 1 rotor to 1 stator varies as the cosine of the angle of rotation; 0.020″ air gap; 7–13/64″ lg x 3–51/64″ wd x 3–7/8″ h o/a; 9 brass, silver pl plates ea sect; continuous rotation, motor driven; ceramic insulation; post term; four 13/32″ lg #6–32 thd hex spacer on 1–5/16″ sq mtg/c; capacitor is rotating capacitor goniometer designed to couple the outputs of 2 crossed H Adcock ant into a single output, for high speed direction finding, also includes C402, C403, C404, R401 thru R406, & K401. Bendix part/dwg #ON203298–1	Capacitor variable
C402		Same as C144.	Sense phasing
C403	3D9001E5–9 N16–C–15404–7900 3330–312706100	CAPACITOR, fixed: ceramic; JAN type #CC21UK1R5D; 1.5 mmf; p/m 0.5 mmf; neg temp coef 750 (tol + 250) mmf/-mf/° C; 500 vdcw; 1/4″ diam x 9/16″ lg; 2 axial wire lead term; ceramic ins; temp compensating type; spec JAN–C–20A.	Balancing
C404	3D9003V–20 N16–C–57613–6640 3330–312794144	CAPACITOR, variable: Navy type #(–484955)) air dielectric; neut; concentric types; 0.3 to 3 mmf range; 1500v; 25/32″ lg x 0.327″ max OD; 1 plate metallized glass, cad pl, other plate invar brass; terminated one end by single wire lead, other end by 7/32″ lg mtg bushing w/ #12–24 thd; scdr slot adj; Corning Glass similar to type C–#690082. Bendix part/dwg #C219044–3	Balancing
C405	3DB3–20 N16–C–49578–2076 3330–317126015	CAPACITOR, fixed: Navy Type #(–484953–10); paper; 1 sect; 3mf p/m 10% 600 vdcw; HS metal case; 3–3/4″ lg x 1–1/2″ OD; mineral oil impr and filled; 2 solder lug term on bottom; no int gnd connections; bushing w/ 3/4″ –16 thd for single hole mtg on bottom; Incco #6GA300. Bendix part/dwg #C220134–1	Motor phasing

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS: SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
E101	*N17–B–78115–8861	BOARD, terminal: resistor mtg; 18 solder lug term; irregularly spaced phenolic per JAN–P–13/LTS–E–4; 25/64" thk x 1–1/8" wd x 6–1/2" lg excluding mtg studs; has two 1–1/8" lg mtg studs w/ 6–32 tapped end; stenciled w/ "E101" and various electrical symbols. Bendix part/dwg #C208147–1	For mtg resistors and capacitors
E102	3Z770–14.49 *N17–B–78034–2896 8880–399650169	BOARD, terminal: 14 tinned brass solder post term spaced 0.30" apart in 2 rows of seven, .090" between rows; phenolic 2.56" lg x 1.30" wd 23/32" thk; two #6–32 tapped inserts on 1.800" mtg/c. Bendix part/dwg #C203540–1	For mtg resistors
E103	3Z770–15.12 *N17–B–77990–8876 8880–387256992	BOARD, terminal: 12 tinned brass solder post term irregularly spaced; phenolic; 7.90" lg x 1.20" wd x 1/8" thk; two 0.171" diam holes on 7–1/2" mtg/c, one #6–32 tapped insert in ctr. Bendix part/dwg #C203542–1	For mtg resistors
E104	3Z770–28.16 *N17–B–78212–3573 8880–387257646	BOARD, terminal: 28 tinned brass solder post term irregularly spaced; phenolic 5" lg x 1.30" wd x 1/8" thk; two #6–32 tapped inserts on 3.100" mtg/c. Bendix part/dwg #C203693–1	For mtg resistors and capacitors
E105	3Z770–36.19 *N17–B–78252–8665 8880–387257809	BOARD, terminal: 36 tinned brass solder post term irregularly spaced; phenolic 7.40" lg x 1.10" wd 1–19/32" thk; two #6–32 tapped inserts on 6.200" mtg/c. Bendix part/dwg #C203543–1	For mtg resistors
E106	3Z770–10.45 *N17–B–77940–6601 8880–387256695	BOARD, terminal: 10 tinned brass solder post term irregularly spaced; phenolic; 7.70" lg x 1–1/4" wd x 1/8" thk; three 0.171" diam holes in straight line, 5.450" lg between 1st and 3rd, 3.050 lg between 1st and 2nd. Bendix part/dwg #C203541–1	For mtg resistors
E107	3G350–111 N17–I–69172–6201 3320–331265915	INSULATOR, standoff: Navy Type #(–61166); round; white ceramic, glazed; 1/2" lg x 1/2" diam; #6–32 thd x 3/16" d tapped hole ea end; Isolantite #397–L1/2. Bendix part/dwg #C56351–40	For C182
E108		Same as E107.	For C182
E109	2Z8304.136 N16–S–34532–8725 3300–295578959	SHIELD, tube: CRS, cad pl; round, open top; locking keyway mtg; 0.950" ID x 1–1/2" h; Cinch #16G12626. Bendix part/dwg #C242782–1 or TS103U01	For V103
E110		Same as E109.	For V109
E111		Same as E109.	For V111
E112		Same as E109.	For V114
E113	2Z8304.57 N16–S–34250–3862 3300–295578675	SHIELD, tube: JAN type #S0S3 CRS, cad pl; round; open top; locking keyway mtg; 0.810" ID x 1–3/8" h; Cinch #8660. Bendix part/dwg #L76151 or TS102U01	For V104
E114		Same as E113.	For V117
E115		Same as E113.	For V118
E116		Same as E113.	For V119
E117		Same as E113.	For V120
E118		Same as E113.	For V105
E119		Same as E113.	For V106
E120	2Z8320–13 N16–S–34557–8350 3300–295580677	SHIELD, tube: JAN type #S0S6, CRS, cad pl; round; open top; locking keyway mtg; 0.810" ID x 1–3/4" h; Cinch #8661. Bendix part/dwg #L76151–1 or TS102U02	For V125
E121		Same as E120.	For V126

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS (SIGNAL CORPS STANDARD NAVY AIR FORCE)	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
E122		Same as E109.	For V121
E123		Same as E109.	For V122
E124	2Z5822–192 N16–K–700266–501 3320–292241364	KNOB: round; black E aluminum; for 1/4" diam shaft; two #6–32 set screw; 5/8" diam x 7/16" h; 5/16" d shaft hole. Bendix part/dwg #OA121070	For R132
E125		Same as E124.	For R140
E126		Same as E124.	Dial locking
E127	2Z5822–443 N16–K–700418–786 3320–292241615	KNOB: round; black bakelite; for 1/4" diam shaft; double #6–32 set screw; 2–3/8" OD x 1.979" lg o/a; brass insert; 1.510" d shaft hole; brass bushing 2.12" diam x 0.63" wd fastened to back of knob w/ three #4–40 thd screws. Bendix part/dwg C203742–1	For tuning capacitor
E128	2Z2712.1 N17–C–800645–401 3300–287222500	CLIP: electron tube; spring brass, cad pl; 1–1/8" lg x 5/8" wd x 9/16" h; ceramic ins; 1 socket cont; for 3/8" diam cont; Natl Co. #SPP–3. Bendix part/dwg #A113222	For V128
E129		Same as E109.	For V124
E130	3G320–159 *N17–I–64417–2021 3320–331250760	INSULATOR, plate: rectangular; phenolic per JAN–P–13/LTS–E–4, grade XXX; 1–41/64" lg; 1–39/64" wd x 3/8" thk, w/ three 0.161" diam holes irregularly spaced; ctb 0.31" diam, 1 mtg hole 0.406" diam w/ ctb 0.750" diam on opposite side, 1 notch on end 0.58" from side 3/8" lg x 0.160" wd x 0.08" d. Bendix part/dwg #C243138	For R230
E131	3G320–158 *N17–I–64417–2026 3320–331250759	INSULATOR, plate: rectangular; phenolic per JAN–P–13/LTS–E–4; 1–41/64" lg; 1–39/64" wd x 3/8" thk, w/ three 0.161" diam mtg holes and one 0.154" diam hole irregularly spaced: ctb 1/32" diam, one 0.406" diam hole ctb on opposite side 3/4" diam. Bendix part/dwg #C243139	For R228
E132	2Z8304.123 N16–S–35194–1193 3300–295578946	SHIELD, tube: Allegheny elec metal #4750; cylindrical, flared for CR tube; fl mtd; 2–1/2" ID one end, 5–1/2" ID other end; 14–3/16" lg o/a; three 0.161" diam mtg holes spaced 120 deg apart on fl; Millen # per N92860. Bendix #N92860	For V127
E133	2Z5822–44 N16–K–700266–744 3300–292241616	KNOB: round; black E aluminum; for 0.172" diam shaft; double #6–32 set screws; 5/8" diam x 9/16" h; 15/32" d shaft hole; diamond knurl. Bendix #A245195	For R228
E134		Same as E133.	For R230
E135		Same as E133.	For R199
E136		Same as E133.	For R200
E137		Same as E133.	For R228
E138		Same as E133.	For R151
E139	3Z770–6.73 *N17–B–77743–3500 8880–387256423	BOARD, terminal: 6 tinned brass solder post term irregularly spaced; phenolic; 4.88" lg x 0.40" wd x 1/8" thk; two 0.140" diam holes on 3.093" mtg/c. Bendix part/dwg #A203714–1	For mtg R102, R106, R114
E140		Same as E107.	For E106
E141		Same as E107.	For E106
E142		Same as E107.	For E106
E143		Same as E113.	For V107
E144		Same as E109.	For V108

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8-4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD-2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS — SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
E145		Same as E109.	For V110
E146		Same as E113.	For V101
E147		Same as E113.	For V102
E148		Same as E109.	For V123
E149	3Z12041-3.3 N17-T-28227-4106 8880-396321871	TERMINAL, stud: brass stud molded in phenolic; 5/16" diam x 1-27/64" lg o/a; #6-32 tapped hole one end for mtg. Bendix part/dwg #AA109425-1	Wiring connection
E150		Not Used.	
E151	F16-R-33591-1258 1700-018782200	RECEIVER SUB-ASSEMBLY: complete gear train, main tuning and osc capacitors; ratio of knob shaft to condenser 40 to 1; 8-1/8" lg x 5" wd x 7" h o/a; various size holes on front and rear of unit for mtg; similar to OR203511-1 except for change in dial light, and capacitors shields. Bendix part/dwg #OR203511-2	Capacitors and drive
E152	2Z2712.170 N17-C-813511-101 3300-287222714	CLIP: electron tube; brass, tin pl; 1-13/64" lg x 47/64" wd x 25/64" h o/a; rubber ins; one solder lug connection for 1/8" diam cont; Cinch per A242240. Bendix part/dwg #A242240	For V127
E153	2Z9401.92 *N17-B-77482-7682 8880-296619227	TERMINAL, stud: brass stud molded in phenolic; 11/16" lg x 3/8" wd x 19/32" h #6-32 thd hole for mounting. Bendix part/dwg #AA109421-1	Support for R109
E301	N16-A-51082-1266 1700-015086350	ANTENNA: whip type; transmitting; phenolic tube per JAN-P-79/LTS-E-4 w/ brass chrome pl whip; telescopic; 50" extended, 10-3/4" collapsed; 4 sect; mts by means of 1/2"-24 thd bushing; Ward Prod Corp per Bendix N222358. Bendix #N222358	Antenna
E302	N16-D-46353-7451 3320-080150020	DIAL: c/o aluminum dial and black bakelite knob; for 1/4" diam shaft; two #10-32 set screw; brass insert; 11/16" d shaft hole; dial calibrated from 100 to 160 mc on 180 deg arc; 2-3/4" diam x 15/16" h. Bendix part/dwg #C203404-2	For C301
E303	2Z5838 N16-K-700065-901 3320-292266000	KNOB: bar; molded bakelite; for 1/4" diam shaft; one #8-32 set screw; engraved w/ white arrow; 1-1/4" lg x 3/4" wd x 19/32" h; brass insert; 9/16" d shaft hole; Kurz-Kasch #S-292-3-L. Bendix part/dwg #A100228	For S301
E304		Same as E120.	For V301
E305	N17-I-49277-2211 3320-080550010	INSULATOR, bushing: round; plastic per MIL-P-5425(MM); 1/2" h; 2" OD x 5/8" ID, six 0.136" diam mtg holes equally spaced on 1.60" mtg diam. Bendix part/dwg #C293592	Antenna
E401	3Z770-8.66 *N17-B-77837-6875 8880-387256567	BOARD, terminal: 8 term, solder lug one side, other side tapped #6-32 term in 2 rows irregularly spaced; phenolic; 2.64" lg x 2.38" wd x 1/8" thk; four 0.161" diam holes on 1.64" x 2" mtg/c. Bendix part/dwg #C203824-1	Motor alternator board

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
E402	3Z770–1.16 *N17–B–77484–8225 8880–387256017	BOARD, terminal: single brass, cad pl #4–40 thd insert; phenolic; 1.52″ lg x 1/2″ wd x 0.187″ thk; two 0.120″ diam holes on 1.200″ mtg/c. Bendix part/dwg #C203934–1	Relay terminal board
E403	——————— N16–C–71576–1001 1700–309600000	COIL, MARKER GENERATOR: calibration coil; c/o phenolic form w/ 8000 turns #43E wire and GE magnet #4Y33P2 cemented to form; phenolic; coil to work w/ rotating, 36 tooth wheel of magnetic matl, coil placed w/ permanent magnet barely clearing teeth of rotating wheel AC generated in wnd as wheel rotates due to varying magnetic field thru coil, 1 cyc of AC generated for ea 10 deg of rotation, AC is displayed on polar diagram on face of CRT so that peak of ea cyc is at the rim of tube and exactly 10 deg apart. Peaks are used to calibrate polar diagram; 23/32″ lg x 0.56″ wd x 27/32″ h; single #6–32 thd mtg hole on side. Bendix part/dwg #C215524–1	Tone wheel pick-up coil (p/o E445)
E404	——————— ——————— ———————	GEAR: spur, steel, cad pl; used to generate AC current in gen field wnd; 36 straight teeth; 24 pitch, 1–1/2″ PD; 1.68″ OD x 0.12″ thk w/ 1/4″ diam bore; straight face; 1/2″ diam hub extending 1/4″ from gear face; one #6–32 tapped hole and one 0.067″ diam hole spaced 90 deg apart 1/8″ from end of hub. Bendix part/dwg #C238254 Listed for reference only.	Tone wheel not replaceable (p/o E445)
E405	2Z4868.776 N17–G–163726–271 1700–291618220	GASKET: fairprene; 7 holes; round; 6–1/2″ OD x 0.025″ thk; center hole 5–1/2″ diam, six 0.281″ diam holes spaced 60 deg apart on 6″ mtg/diam. Bendix part/dwg #L233507	Between housing and element support
E406	2Z4868.769 N17–G–154348–840 1700–291618213	GASKET: fairprene, 5 holes; rectangle, 1.88″ lg x 1.66″ wd x 0.025″ thk; ctr hole 3/4″ wd x 1.1″ lg, four 0.166″ diam holes on 1–1/2″ x 1.08″ mtg/c. Bendix part/dwg #C233506	Between waveguide and cross arm
E407		Same as E406.	Between waveguide and cross arm
E408	2Z4868.770 N17–G–150481–895 1700–291618214	GASKET: fairprene; 7 holes, irregular shape, 4–11/16″ lg x 3–15/16″ wd x 0.025″ thk. Bendix part/dwg #C233504	Between main support and cross arm
E409	2Z4868.771 N17–G–150537–738 1700–291618215	GASKET: fairprene; ant housing; 8 holes; irregular shape, 4–11/16″ wd x 5–11/16″ lg x 0.025″ thk. Bendix part/dwg #C233505	Between top cover and cross arm
E410	2Z4868.772 N17–G–154151–471 1700–291618216	GASKET: fairprene; four holes; rectangular; 1–1/2″ sq x 0.025″ thk; holes 0.136″ diam on 1.120″ sq mtg/c. Bendix part/dwg #A233500	For cross arm cover plates
E411		Same as E410.	For cross arm cover plate
E412		Same as E410.	For cross arm cover plate
E413		Same as E410.	For cross arm cover plate
E414	2Z4868.773 N17–G–154207–966 1700–291618217	GASKET: fairprene; 5 holes; rectangular, 1–5/8″ sq x 0.025″ thk w/ ctr hole 1.312″ diam and four 0.120″ holes on 1.156″ sq mtg/c. Bendix part/dwg #A233502	Between J402 and ant base

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TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
E415	2Z4868.774 N17–G–154059–538 1700–291618218	GASKET: for wave guide 1″ x 1/2″; neoprene; single hole; rectangular 1.32″ lg x 0.82″ wd x 0.22″ thk. Bendix part/dwg #A233453	Between waveguide and main support
E416		Same as E415.	Between waveguide and main support
E417	2A288B–5 N16–A–61925–6367 1700–202599480	ANTENNA ELEMENT: SS, passivated; tubr; 29.14″ lg o/a x 1–3/16″ max OD; one end w/ cap, other end w/ stud 3/8″–16 thd 1/2″ lg for mtg. Bendix part/dwg #C203729–1	Collecting element
E418		Same as E417.	Collecting element
E419		Same as E417.	Collecting element
E420		Same as E417.	Collecting element
E421	2A288B–4 N16–A–61933–6113 1700–202599479	ANTENNA ELEMENT: SS, passivated; tubr; 31–1/8″ lg o/a x 1–3/16″ max OD; one end w/ cap, other end w/ stud 3/8″–16 thd 1/2″ lg for mtg. Bendix part/dwg #C203729–2	Collecting element
E422		Same as E421.	Collecting element
E423		Same as E421.	Collecting element
E424		Same as E421.	Collecting element
E425	2A288B–6 N16–A–61945–7246 1700–202599481	ANTENNA ELEMENT: SS, passivated; tubr; 35–3/8″ lg o/a x 1–3/16″ max OD; one end w/ cap, other end w/ stud 3/8″–16 thd 1/2″ lg for mtg. Bendix part/dwg #C203729–3	Sense element
E426	N17–I–59792–6101 3320–082740040	INSULATOR, feedthru; round shape; cad pl brass cap and connecting rod, ceramic ins; 2–7/8″ lg o/a; 2–1/8″ diam, mts by 1–1/2″–12 thd bushing. Bendix part/dwg #C208453–1	Antenna element
E427		Same as E426.	Antenna element
E428		Same as E426.	Antenna element
E429		Same as E426.	Antenna element
E430		Same as E426.	Antenna element
E431		Same as E426.	Antenna element
E432		Same as E426.	Antenna element
E433		Same as E426.	Antenna element
E434	N17–I–59792–7101 3320–082740050	INSULATOR, feedthru: round shape; cad pl brass cap and connecting rod, ceramic ins; 2–59/64″ lg o/a; 2–1/8″ diam, mts 1–1/2″–12 thd bushing. Bendix part/dwg #C208459–1	Sense element terminals
E435		Not Used.	
E436		Not Used.	
E437		Not Used.	
E438		Not Used.	
E439		Not Used.	
E440		Not Used.	
E441		Not Used.	
E442		Not Used.	
E443		Not Used.	

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
E444	2Z4868.775 N16–W–180001–254 1700–291618219	WASHER, flat: neoprene; single hole; round 1–5/16″ OD x 5/8″ ID x 0.085″ thk. Bendix part/dwg #OA107770–45	For J401
E445	2A264–410–1 *N16–A–70501–1023 1700–202161422	ANTENNA SUB-ASSEMBLY: c/o motor G401 gear E404 and wnd E403; 4″ lg o/a x 2.62″ wd x 3.18″ h; three 0.161″ diam mtg holes, 2 spaced 2″ apart, other ctr and spaced 1.960″ lg from initial holes. Bendix part/dwg #L203564–1	Circular sweep
E445A	N16–A–70501–1036 1700–017247040	ANTENNA SUB-ASSEMBLY: 0.06 w output at 1800 rpm; 0.5v output per 100 rpm, 30 cyc, 2 ph, 4 wires; closed frame; −40°C to +50°C ambient temp; 2–1/2″ lg x 2–1/4″ diam x 5/8″ lg shaft one end, other end of shaft has 36 teeth, 24 pitch, 1.500 PD tone wheel mtd by two #6–32 set screws spaced 90 deg apart; dustproof; self excited; fixed mtg base; two #6–32 thd x 3/16″ d holes each end 1–1/4″ c to c; perm magnet rotor. Bendix part/dwg #L203564–2	
E446	2Z10008–134 N16–T–25301–1255 1700–297779781	TRANSMISSION LINE SECTION: transmission; c/o 2 brass lines & 2 textolite ins; 7.12″ lg o/a x 1.085″ OD; 2 solder lug term one end; self supporting. Bendix part/dwg #C203825–1	Connects elements to goniometer
E447		Same as E446.	Connects elements to goniometer
E448		Same as E446.	Connects elements to goniometer
E449		Same as E446.	Connects elements to goniometer
E450	N16–P–401881–185 1700–018481000	PLATE, cover: end plates for cross arms of ant; aluminum alloy, ocean gray E paints; sq; 1–1/2″ sq x 0.064″ thk o/a; four 0.144″ diam holes spaced on 1.120″ sq mtg/c. Bendix part/dwg #A228559	Ant end plate
E451		Same as E450.	Ant end plate
E452		Same as E450.	Ant end plate
E453		Same as E450.	Ant end plate
F101	——— N17–F–16302–120 8800–361212	FUSE, cartridge: Navy type #(–28032–3); 3 amp, continuous at 110%; blow at 135% in 60 min, blow at 200% in 2 min; 250v; one time; glass body; ferrule term; 1–1/4″ lg x 1/4″ diam; NEC term; Littelfuse #312003. Bendix part/dwg #C221603–302	T301 pri
G401	N17–G–47976–1245	GENERATOR, AC: Navy Type #(–212031); 0.5 V per 100 rpm, 60 cyc, 2 ph, 4 wire, 0.06 W per ph at 1800 rpm; closed frame; ambient temp −40°C to +50°C; 2–1/2″ lg x 2–1/4″ OD; dust proof; 1/4″ diam plain shaft ea end, one end 0.625″ lg, other end 0.843″ lg; permanent magnet; two #8–32 tapped holes 3/16″ d on 1–1/4″ mtg/c ea end; Elec Indicator #FSPD 154. Bendix part/dwg #L222821–1 Listed for reference only.	Sweep gen (not replaceable p/o E445)
H101	2Z5042–3 N16–C–300798–621 3300–291697087	CLAMP: Navy Type #(–49679); tube holder, lever locking type; SS; 3/4″ h o/a; single mtg ft w/ slot 3/16″ x 5/16″; for 1–1/4″ diam tube base; Birtcher #926B. Bendix part/dwg #L74947–2	For R238

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
H102	2Z2636–28 N16–C–300798–452 3300–287172860	CLAMP: Navy Type #(–49496); tube holder, lever locking type; SS; 3/4" h o/a; single mtg ft w/ slot 3/16" x 5/16"; for 1–5/32" diam tube base; Birtcher #926A. Bendix part/dwg #L74947–1	For V116
H103	2Z2636–26 N16–C–300798–866 3300–287172845	CLAMP: Navy Type #(–49680); tube holder, lever locking type; SS; 3/4" h o/a; single mtg ft w/ slot 3/16" x 5/16"; for 1–3/8" diam tube base; Birtcher #926C. Bendix part/dwg #L74947–3	For V112
H104		Same as H103.	For V113
H105		Not Used.	
H106		Not Used.	
H107	2Z1250.174 N16–M–60909–7976 3330–286393635	MOUNTING: JAN type CP07SA2; capacitor mtg; "J" shape spade lug type; CRS; for capacitor 1–13/16" lg x 1–1/16" wd x 2–1/4" h; two #10–32 thd studs spaced on 2–1/16" mtg/c; 2 bkt required; spec JAN–C–25.	For C181
H108		Same as H107.	For C183
H109	——————— N41–W–2460–1 7900–859441	WRENCH: Bristo set screw; 0.076" diam, long arm 1–27/32" lg, short arm 21/32" lg; steel, cad pl; for #6 set screw; Bristolco. Bendix part/dwg #HC684H03–S	For #6 set screws
H110	——————— N43–S–16665–3000 6700–732555–4	SCREW, set: Bristo 4 spline drive; headless; steel, cad pl; #6–32 NC–2; 1/8" lg; cup point; Bristolco. Bendix part/dwg #HC928H04–632	Used on knobs and gears (quan of 26)
H111	——————— N43–S–17333–1210 6700–732600	SCREW, set: Bristo 4 spline drive; headless; steel, cad pl; #6–32 NC–2; 3/16" lg cup point; Bristolco. Bendix part/dwg #HC928H06–632	Used on knob, shaft and gear (quan of 12)
H112	——————— N43–S–17340–2527 6700–732602	SCREW, set: Bristo 4 spline drive; headless; steel, cad pl; #6–32 NC–2; 1/4" lg; cup point; Bristolco. Bendix part/dwg #HC928H08–632	Used on dial stop (quan of 2)
H401		Same as H112.	Used on gear
H402	——————— N43–S–16559–500 6700–736160	SCREW, set: Bristo 4 spline drive; headless; steel, cad pl; #6–32 NC–2; 1/4" lg; flat point. Bendix part/dwg #HC929H08–632	For RF transmission line sect (quan of 16)
H403	——————— G43–S–17350 6700–732899–5	SCREW, set: Allen drive; headless; steel; cad pl; #10–24 NC–2; 3/16" lg; cup point. Bendix part/dwg #HC922H06–1024	For flex coup (quan of 6)
H404		Same as H109.	For #6 set screws
H405	——————— G41–W–2449 7900–859500	WRENCH: Allen head set screw; 3/32" across flats; "L" shape, lg arm 2–3/32" lg, short arm 3/4" lg; hardened steel, cad pl; for #10 Allen head set screw. Bendix part/dwg #HC685H05–S	For #10 set screw
I101	——————— N17–L–6297 8800–444163	LAMP, incandescent: 6.3v, 0.15 amp; bulb T3–1/4 clear; 1.19" lg max o/a; miniature bayonet base; C–2, tung fil; burn any position; GE Mazda #47. Bendix part/dwg #A9320	Illuminate dial
I102	——————— N17–L–6543–175 8800–444065	LAMP, incandescent: 6v, 1.2w; T–1–3/4 clear; 5/8" lg o/a; midget flange base; C–6 filament; burn any position; GE part #328. Bendix part/dwg #C221312–2	Illuminate scale
I103		Same as I102.	Illuminate scale
I104		Same as I102.	Illuminate scale

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
I301	3F30825–1 N18–C–1597–3150 1700–328550884	COMPASS, magnetic: moving needle type; dial scale markings from zero in both directions from "N" and from "S" to 90 deg at "E" and "W", numbered every 10 deg; housing is bronze or aluminum w/ black wrinkle finish; 5–1/8" OD x 4–19/64" d o/a; mts on Jacob staff or tripod; w/ ball and socket joint; K & E #5334. Bendix part/dwg #C65463	Compass
J101	——— N17–C–73114–7071	CONNECTOR, receptacle: 1 round female cont; straight type; 11/16" diam x 1–13/16" lg; 50 ohm constant impedance; round silver pl brass body; Teflon insert; 1" sq mtg fl w/four 1/8" diam holes spaced on 23/32" sq mtg/c; IPC #36000. Bendix part/dwg #C223390–15	Ant connector gr V101
J102	——— N17–J–39248–4418 8850–749430	JACK, telephone: JAN type JJ–034; Sig C type JK–34–A; for 2 cond plug 0.25" diam x 1" lg; 1–3/16" lg o/a x 1" diam approx; J1 cont arrangement; 3.8"–32 thd bushing 1/4 lg for mtg w/ 2 hex nuts and 1 washer; spec JAN–J–641.	Phone jack secd ckt Z106A
J103	——— N17–C–72611–9605 8850–538625–52	CONNECTOR, receptacle: MIL #AN3102A–22–4P; four round male cont; 1–3/4" lg x 1–13/32" diam; two 40 amp cont, two 25 amp cont; cylindrical aluminum alloy shell, sandblast; melamine insert; one 5/8" sq fl w/ four 0.120" diam holes spaced on 1–1/4" mtg/c; 1–3/8"–18 thd coupling.	Power input
J104	——— N17–C–72263–4968 8850–563880–52	CONNECTOR, receptacle: MIL type #AN3102A–20–7S; 8 round female cont; 1–3/4" lg x 1–9/32" diam; eight 10 amp cont; cylindrical aluminum alloy shell; sandblast; melamine insert; 1–1/2" sq fl w/ four 0.120" diam holes spaced on 1–5/32" mtg/c; 1–1/4"–18 thd coupling.	AS–410/URD–2 power
J105	——— N17–C–73112–1050 8850–482625	CONNECTOR, receptacle: 1 round female cont; straight type; 1–1/2" lg x 31/64" diam o/a; cylindrical brass, silver pl body; phenolic ins; single hole panel mtg by 3/8"–32 thd portion on body. Bendix part/dwg #C204619–1	Power for I102, 103, 104
J401	——— N17–A–36191–1002 8850–110150	CONNECTOR, adapter: AN type #UG–538/U; 1 end female, other end coupling for support ctr element within waveguide; straight type; 1–3/4" lg x 1–15/16" wd x 1" h o/a; impedance not constant; cylindrical brass, cad pl body and SS mtg plate; 0.196" diam cable opening; mtg by plate w/ four 1/8" diam holes on 1.160" x 0.720" mtg/c. Bendix part/dwg #C203772–1	Antenna RF output
J402	——— N17–C–72627–4968 8850–566042–52	CONNECTOR, receptacle: MIL type #AN3102A–20–7P; 8 round male cont; 1–5/8" lg x 1–5/32" diam; eight 10 amp cont; cylindrical aluminum alloy shell, sandblast; melamine insert; 1–3/8" sq fl w/ four 0.120" diam holes spaced on 1–1/16" mtg/c; 1–1/8"–18 thd coupling.	Antenna power
J403	——— N17–C–78538–5612 8850–150400	CONNECTOR, plug: banana type; single cont; straight type; 25/32" lg w/ #6–32 thd stud 3/8" lg; brass, nickle pl; single solder lug term; EF Johnson Cat. #75A. Bendix part/dwg #A11705–1	Sense antenna connector
K401	2Z7587–257 N17–R–65555–2929 3380–294797866	RELAY, armature: Navy Type #(–291766); SPST; palladium cont; cont 150w, 3 amp; single wdn coil, 110v DC, 18.3 ma, 6000 ohms p/m 10%, ins; solder lug term on coil and cont; 1.56" lg x 5/8" wd x 13/16" h; less cont; four #4–40 thd holes x 1/16" d on 3/8" x 7/16" mtg/c; fast acting; mp; Price Electric series #5700 special. Bendix part/dwg #L218264	Sense relay

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS (SIGNAL CORPS STANDARD NAVY AIR FORCE)	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
L101	3C1084C–46 *N16–C–71656–2054 3340–308412537	COIL, RF: ant, single wnd, helical wnd; unshielded; 1 turn of #16 wire (approx) 1–5/16" lg x 39/64" wd x 3/8" h o/a incl term; air core; pre-formed; mts by leads; two wire lead term. Bendix part/dwg #A215604	Ant coil gr ckt V101
L102	3C1084C–45 *N16–C–71656–7209 3340–308412536	COIL, RF: ant; single wnd, helical wnd; unshielded; 1 turn of #16 wire (approx) 1–3/8" lg x 5/8" wd x 19/64" h, incl term; air core; pre-formed; mts by leads; two wire lead term. Bendix part/dwg #A215605	RF coil pl V101
L103		Same as L102.	RF coil gr V103
L104	N16–C–76881–9658 3340–296950748	COIL, RF: osc; 2 wnd, single layer wnd; unshielded; one wnd 7 turns #16 copper wire, other wnd approx 1–3/4" turns #16 copper wire; 1–3/4" lg x 5/8" diam; ceramic form w/ powdered iron core inserted; form 7/16" diam x 1–3/4" lg; adj iron core; screw adj thru end of coil form; #6–32 tapped mtg hole 0.53" d on one end; four wire lead term, two on ea; incl mtg bkt for support of iron core and nut for holding in place. Bendix part/dwg #C215580–2	Osc coil, gr V102
L105	3C336–160 N16–C–72899–1028 3340–307768810	COIL, RF: Navy Type #(–471660); choke; 1 wnd, single layer wnd; unshielded; 3 uh, 50 turns, #38E wire; 3/8" lg x 5/32" diam; resin bonded core; 2 axial wire lead term 1–1/4" lg; Jeffers Electronics #CF13/8–50/38. Bendix part/dwg #C215092–1	Osc choke coil, pl V102
L106	3C336–21 *N16–C–72556–4604 3340–307764000	COIL, RF: filter choke; single layer wnd unshielded; 38 turns #28 E wire; 11/16" lg x 1/4" diam; bakelite form; 1–1/2" lg pigtails; 2 axial wire lead term. Bendix part/dwg #AA104301–1	V107 filament filter
L107	3C575N–2 N16–R–29153–1868 3340–310006057	REACTOR: Navy Type #(–303453); filter choke; 7 hy, 75 ma DC; 120 ohms DC; 1500v RMS test; HS metal case; 3" h less term x 2" sq; 2 glass ins solder lug term on bottom; four #6–32 thd x 1/4" d mtg holes on 1–1/2" sq mtg/c. Bendix part/dwg #A213002	Filter choke cath V113
L108		IF TRANSFORMER SUB-ASSEMBLY: Listed for reference only.	p/o Z101 not replaceable
L109		IF TRANSFORMER SUB-ASSEMBLY: Listed for reference only.	p/o Z101, not replaceable
L110		Same as L108.	p/o Z102, not replaceable
L111		Same as L108.	p/o Z102, not replaceable
L112		Same as L108.	p/o Z103, not replaceable
L113		Same as L108.	p/o Z103, not replaceable
L114		Same as L108.	p/o Z104, not replaceable
L115		Same as L108.	p/o Z104, not replaceable
L116		IF TRANSFORMER SUB-ASSEMBLY: Listed for reference only.	p/o Z105, not replaceable
L117		Same as L116.	p/o Z105, not replaceable

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
L118	3C336–158 N16–C–72577–3769 3340–307768808	COIL, RF: filter; 1 wnd, single layer wnd; unshielded; approx 42 turns #20 E wire; 1–1/2" lg x 3/8" diam; phenolic form; 2 axial wire lead term. Bendix part/dwg #C215551–1	Power input filter
L119		Same as L118.	Power input filter
L301	*N16–C–71656–6005 3340–060701210	COIL, RF: antenna; single wnd; unshielded; two complete turns of #16 copper wire; 23/64" diam x 1–3/8" lg approx; two wire leads. Bendix part/dwg #A216012	Osc
L302	*N16–C–71597–6090 3340–060701200	COIL, RF: oscillator; unshielded; c/o #16 ga copper wire, 1/2 turns; 27/64" wd x 3/16" h x 1–1/2" lg o/a; #16 ga wire leads. Bendix part/dwg #A216013	Ant coil
L303		Same as L105.	Pl choke V301
L304		Same as L105.	Fil choke V301
L305		Same as L105.	Fil choke V301
L401	2Z9629–247 N16–C–75785–4115 3340–296950747	COIL, RF: RF transf; 2 concentric wnd; single layer wnd; unshielded; 2–1/4 turns #22 AWG bare copper wire on outer form, 6 turns #18 AWG bare copper wire on inner form; 1–3/32" lg x 7/16" max OD; one #4–40 x 1/2" d mtg hole in end of inner form; four wire lead term, 2 ea form; p/o C–401. Bendix part/dwg #C215592–1	Sense coup coil
M301	3F872–1 N17–M–19052–1051 3300–325228040	METER, ammeter: DC; JAN type MR25W200DCUA; 0 to 200 ua; round molded phenolic flush mtg case; 2–13/64" diam bbl x 1–19/32" d; round fl 2–45/64" diam x 3/8" thk; 2% accuracy for full scale reading; 150 mv drop across term; calibrated for non-magnetic panel; scale & pointer per spec JAN–I–6; meter is self contained; three 1/8" diam holes equally spaced on 1.22" rad; two 1/4–28 thd x 45/64" lg term on rear of case; spec JAN–I–6.	Gr
N101	N16–C–99511–1007 3320–080550060	CURSOR, indicator: rotatable scale for visual indication of direction finder signal; round, aluminum Navy gray E, 7–3/8" OD x 2–5/32" d o/a; c/o housing w/ rotating ring and green plexiglass window w/ arrow, 2 vert parallel lines and 1 horiz line, 0 to 360 deg scale numbered every 10 and marked every 2 deg, light ring with lamps and miscellaneous hdw; three #10–32 tapped holes spaced 120 deg apart on 7–1/8" mtg diam. Bendix part/dwg #N208182–1	Az brg indicator
N102	2Z3765–12 N16–S–117101–515 3320–291456778	SCALE: c/o plexiglass dial and brass, cad pl disk & hub w/ neoprene stop; 100 to 155 mc scale, numbered every 5 mc, marked every 1 mc; 4" diam x approx 0.588" d o/a; 1/4" diam shaft hole, two #6–32 tapped holes for set screw mtg. Bendix part/dwg #C203719–1	Dial
N103		PLATE, scale: cursor indicator for CRT indication; green plexiglass; round shaped; 5.720" OD x 1/8" thick, approx o/a; four "U" shaped mtg cutouts 1/8" wd x 1/4" d, spaced 90° c to c on OD; engraved, white filled concentric circle 4" diam, 4" lg arrow through center w/two 2" lg lines at right angles to arrow and two 3" lg lines parallel to arrow 1/4" ea side. Bendix part/dwg #C247063	Follower N103

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
O101	2Z3273–217 N17–C–98431–7727 1700–287658935	COUPLING, rigid: sleeve type; 1/4″ shaft opening ea end; set screw mtg; 13/16″ lg x 11/16″ diam; phenolic w/ brass hub. Bendix part/dwg #A201200–1	For R228
O102		Same as O101.	For R230
O103	2Z4878–1188 N16–G–500001–273 1700–291632816	GEAR ASSEMBLY: c/o brass spur gear, 116 straight teeth, 48 pitch, 2.4138″ PD and brass idler spur gear, 24 straight teeth, 48 pitch, 0.4972″ PD; 2.4555″ OD x approx 0.300″ thk o/a; 0.2505 diam shaft hole. Bendix part/dwg #C203507–1	Dial drive
O104	N16–G–435003–151 1700–017243040	GEAR: c/o hub, spring, fixed spur gear and moving spur gear; brass; ea gear 0.040″ thk, 58 straight teeth, 48 pitch, 1.2055″ PD; 0.2505″ shaft hole; two #6–32 tapped holes in hub for set screw mtg. Bendix part/dwg #C203508–1	Dial drive
O105	2Z4878–1189 N16–G–433214–592 1700–291632817	GEAR, spur; brass; straight teeth; 116 teeth; 48 pitch, 2.4138″ PD; 2.4555″ OD x 0.376″ bore x 0.400″ thk o/a; straight face; hub 0.62″ OD x 2.220″ wd two #6–32 tapped holes for set screw mtg. Bendix part/dwg #C203509–1	Dial drive
O106	2Z8996–26 *N16–S–685341–107 1700–296476000	STOP, dial: c/o brass, cad pl disk & hub w/ neoprene stop; 3.60″ OD x 0.410″ thk o/a; 1/4″ shaft hole, two #6–32 tapped holes for set screw mtg. Bendix part/dwg #C203510–1	Dial drive
O107		SHAFT: cursor indicator driving; SS, passivated; 2.11″ lg x 0.2497″ diam, center drilled 60° x 0.187″ diam one end; position maintained by #4–40 set screw. Bendix part/dwg #A239582–1	Dial drive
O108	2Z4878–1174 N16–G–431475–911 1700–291632802	GEAR: spur; brass; straight teeth; 29 teeth; 48 pitch, 0.6014″ PD; 0.6431″ OD x 0.2505″ bore x 0.38″ thk o/a; straight face; hub 1/2″ OD x 0.20″ wd; two #6–32 tapped holes for set screw mtg. Bendix part/dwg #A238250	Dial drive
O109	2Z8204–184 *N16–S–20929–9498 1700–295559995	SHAFT: SS, passivated; 0.2495″ diam x 2.20″ lg. Bendix part/dwg #A239852	Dial drive
O110	2Z2935–95 *N16–C–599931–131 1700–287267767	COLLAR, shaft: brass, nickel pl; no dimen greater than 1″; #6–32 tapped hole and one 1/16″ diam hole 90 deg apart for mtg. Bendix part/dwg #A14145	Dial drive
O111	2Z6195.19 N16–C–302438–869 3320–292597578	CLAMP: dial lock; clamp mechanism; approx 1–3/4″ lg x 3/4″ h x 1–9/16″ wd o/a; cad pl CRS bkt & shaft mtg; bkt w/ two 0.161″ diam mtg holes; 1/4″ diam flatted shaft for knob. Bendix part/dwg #C203715–1	Dial lock
O112	2Z8877.171 *N17–S–46679–3721 1100–299442704	SPRING: helical compression; plate adj; 0.035″ diam nickeled music wire; 2–1/2″ lg x 9/32″ ID; 15 complete turns; closed ends. Bendix part/dwg #A239054	CRT pressure
O113		Same as O112.	CRT pressure
O114		Same as O112.	CRT pressure
O115	N16–G–500001–338 1700–017243020	GEAR ASSEMBLY: c/o hub, 2 springs, fixed spur gear and moving spur gear; brass; ea gear 0.040″ thk, 132 straight teeth, 48 pitch, 2.7472″ PD; 0.376″ shaft hole; two # 6–32 tapped holes in hub for set screw mtg. Bendix part/dwg #C203506–2	Dial drive

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
O116	2Z8204–182 *N16–S–20881–7191 1700–295559993	SHAFT: coupling; phenolic; 3/4" lg x 1/4" diam. Bendix part/dwg #A239331–6	For coup O101
O117		Same as O116.	For coup O101
O118	2Z8204–179 *N16–S–21061–6691 1700–295559990	SHAFT: coupling; phenolic per JAN–P–79/LTS–MG–1(G–5); 1/4" diam x 11–9/16" lg o/a. Bendix part/dwg #A239331–10	For R228
O119		Same as O118.	For R228
O120	2Z8204–181 *N16–S–20886–4321 1700–295559992	SHAFT: SS, passivated; 1.030" lg o/a x 0.171" diam one end, scdr bit other end. Bendix part/dwg #A239692	For E133
O121		Same as O120.	For E134
O122		Same as O120.	For E135
O123		Same as O120.	For E136
O124		Same as O120.	For E137
O125		Same as O120.	For E138
O126	2Z8877.364 *N17–S–46668–8261 1700–296470138	SPRING: helical compression; 0.018" diam music wire, cad pl; 1/2" lg x 3/16" ID; 9 turns; closed ends. Bendix part/dwg #C239080–2	For E133
O127		Same as O126.	For E134
O128		Same as O126.	For E135
O129		Same as O126.	For E136
O130		Same as O126.	For E137
O131		Same as O126.	For E138
O132	2Z3273–118 N17–C–98373–2551 1700–298300918	COUPLING, flexible: brass collar, beryllium copper spring nickel pl; isolantite spacer; 1–1/4" lg o/a x 11/16" OD; 1/4" diam hole ea end; set screw mtg; Millen #K39001. Bendix part/dwg #A239235–2	For R228
O133		Same as O132.	For R230
O134		Same as O132.	For R228
O135		Same as O132.	For R230
O136	N16–G–500001–308 1700–017243000	GEAR ASSEMBLY: dial drive; c/o hub, 2 springs, fixed spur gear and movable spur gear; ea gear 0.040" thk, 120 straight teeth, 48 pitch, 2.4972" PD; 3/8" diam shaft hole w/ two #6–32 set screws spaced 90 deg apart. Bendix part/dwg #C203506–1	Dial drive
O137	2Z8877.365 N17–S–46711–8995 1700–296470130	SPRING: helical extension type; for gear backlash; 0.016" nickeled music wire; 1/2" lg o/a x 0.157" OD; 10–1/2 turns; hook term ea end. Bendix part/dwg #A104499	For O115
O138		Same as O137.	For O136
O139		Same as O137.	For O115
O140		Same as O137.	For O136
O141	2Z8204–180 *N16–S–20884–2824 1700–295559991	SHAFT: SS, passivated; 0.248" diam one end, 5/16" diam other end w/ 1/16" wd x 1/8" d slot, 29/32" lg o/a. Bendix part/dwg #A239031	For E133
O142		Same as O141.	For E134

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
O143	2Z6820–143 N17–M–75068–3501 1700–298362036	MOUNT, vibration: sq mtg; load rating 10 to 14 lb; 2–3/8" sq x 1–5/8" h; ctr bolt w/pin for attaching to chassis; four 15/64" diam holes on 1–15/16" sq mtg/c; LN Barry #M112–5. Bendix part/dwg #C240510–5	Shockmount
O144		Same as O143.	Shockmount
O145		Same as O143.	Shockmount
O146		Same as O143.	Shockmount
O301	2Z307–112 N16–A–22224–1001 1700–286054694	ADAPTER, tripod head: brass, black oxide finish; 3–3/4" OD x 1–7/16" d o/a 3"–12 thd hole 15/32" d one end, other end has 7/8"–24 thd sect 3/8" lg and 45/64" diam axial hole 21/64" d fluted. Bendix part/dwg #C239107	Adapter compass to tripod
O401	2A2546A/C2 N17–C–98378–4616 1700–204751110	COUPLING, flexible: rubber w/ brass hubs, dull black E; 1–3/8" lg x 13/16" max OD, 1/4" ID one end, other end 5/16" ID; mtd to shaft by two #10–24 tap holes ea end; Lord #J–1211–1 special. Bendix part/dwg #C239555–4	Couples B401 to G401
O402	2Z3295–135 N17–C–98378–8879 1700–287696164	COUPLING, flexible: rubber w/ brass hubs, dull black E; 1–3/8" lg x 13/16" max OD, 5/8" OD x 5/16" ID hub ea end; mtd to shaft by two #10–24 tap holes in hubs ea end. Lord #J–1211–1 special. Bendix part/dwg #C239555–1	Couples B401 to C401
P101	——— N17–C–71416–2550 8850–467460	CONNECTOR, plug: AN type UG–21B/U; male, 1 round cont; straight; 13/16" diam x 1–3/4" lg; 50 ohms nom impedance; brass, silver pl body; brass, silver pl cont; teflon insert; 7/16" cable opening; 5/8"–24 int thd on coupling nut for mtg; Amphenol #82–61. Bendix part/dwg #C223397–1	p/o W501
P102		Not Used.	
P103	——— N17–C–70335–9610 8850–278453–52	CONNECTOR, plug: MIL type AN3106A–22–4S; 4 round female cont; straight; 2–3/16" lg x 1–19/32" diam; two 40 amp cont, two 25 amp cont; cylindrical aluminum alloy shell, sandblast; melamine insert; 1–3/16"–18 thd for mtg to conduit; 1–3/8"–18 thd on coupling ring. MIL type #AN3106A–22–4S	p/o W503
P104	——— N17–C–70611–4968 8850–323860–52	CONNECTOR, plug: 8 round male cont; straight; 2–3/16" lg x 1–15/32" diam; eight ten amp cont; cylindrical aluminum alloy shell, sandblast; melamine insert; 1–3/16"–18 thd for mtg to conduit; 1–1/4"–18 thd on coupling ring; same as AN type #AN3106–20–7P except has wp washer. Bendix part/dwg #C223243	p/o W502
P105	N17–C–73412–2917 8850–195270	CONNECTOR, receptacle: one round male cont; straight type; 3/8" wd x 1/2" h x 1–7/16" lg o/a; brass, silver pl body; phenolic ins; has #6–32 thd portion for mtg. Bendix part/dwg #C204396–2	Power for I101, I102, I103
P106	——— N17–C–71426–7831 8800–230998	CONNECTOR, plug: Navy type #(–491697); 2 flat parallel blades; straight; 2" lg o/a x 1–1/2" diam; 10 amp 250v, 15 amp 125v; rubber body; for 13/32" to 5/8" diam cable; has cable clamp in end; Hubbell #9756. Bendix part/dwg #A104627–2	p/o W503
P301	——— N17–C–71423–6810 8850–265115	CONNECTOR, plug: Navy type #(–491865); male; 2 round cont; straight; 5/8" OD x 1/16" lg less cont; u/w 1–1/2v bat; round phenolic disk w/ brass, nickel pl cont; wires soldered into pin cont; JFD Mfg. #706. Bendix part/dwg #C223429–1	"A" bat plug

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
P302	N17–C–71458–5305 8850–263180	CONNECTOR, plug: Navy type (–491866); male 3 round cont; straight; 15/16″ diam x 7/16″ lg o/a; u/w 45v bat; round phenolic disk w/ brass, nickel pl cont; wires soldered into pin cont; JFD Mfg. #701. Bendix part/dwg #C223429–2	"B" bat plug
P303		Same as P302.	"B" bat plug
P304		Same as P302.	"B" bat plug
P401		Same as P101.	p/o W501
P402	N17–C–70351–4965 8850–320500–52	CONNECTOR, plug: 8 round female cont; straight; 2–3/16″ lg x 1–15/32″ diam; eight 10 amp cont; cylindrical aluminum alloy shell, sandblast; melamine insert 1–3/16″–18 thd for mtg to conduit; 1–1/4″–18 thd on coupling ring; has wp washer. Bendix part/dwg #C223244	p/o W502
R101	3RC10BF104K N16–R–50633–491 3300–381016220	RESISTOR, fixed: comp; 100,000 ohms, p/m 10%; 1/4 w; "F" characteristic; 0.170″ diam x 0.406″ lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF104K	GR V101
R102	3RC10BF105K N16–R–50975–491 3300–381016280	RESISTOR, fixed: comp; 1 megohm, p/m 10%; 1/4 w; "F" characteristic; 11/64″ diam x 13/32″ lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF105K	AVC filter gr V101
R103		Not Used.	
R104	3RC30BF223K N16–R–50373–231 3300–381318120	RESISTOR, fixed: comp; 22,000 ohms, p/m 10%; 1 w; "F" characteristic; 9/32″ diam x 3/4″ lg; ins, RSW and humidity; axial wire lead term; spec JAN–R–11. JAN type RC30BF223K	V drop scr gr V101
R105	3RC42BF822K N16–R–50238–421 3300–381604669	RESISTOR, fixed: comp; 8200 ohms, p/m 10%; 2 w; "F" characteristics; 3/8″ diam x 3/4″ lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC42BF822K	Filter pl
R106	3RC10BF221K N16–R–49661–491 3300–381018000	RESISTOR, fixed: comp; 220 ohms, p/m 10%; 1/4 w; "F" characteristic; 11/64″ diam x 13/32″ lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF221K	Fil pl V101
R107		Same as R101.	Gr V103
R108	3RC10BF271K N16–R–49688–491 3300–381018460	RESISTOR, fixed: comp; 270 ohms, p/m 10%; 1/4 w; "F" characteristic; 11/64″ diam x 13/32″ lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF271K	Cath loading V103
R109	3RC42BF123K N16–R–50310–0480 3300–381316160	RESISTOR, fixed: comp; 12,000 ohms, p/m 10%; 2 w; "F" characteristic; 3/8″ diam x 3/4″ lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC42BF123K	Pl drop V102
R110	3RC10BF103K N16–R–50282–491 3300–381016160	RESISTOR, fixed: comp; 10,000 ohms, p/m 10%; 1/4 w; "F" characteristic; 0.17″ diam x 0.406″ lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF103K	Gr leak V102
R111	3RC10BF100K N16–R–49238–491 3300–381015980	RESISTOR, fixed: comp; 10 ohms, p/m 10%; 1/4 w; "F" characteristic; 0.17″ diam x 0.406″ lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF100K	Parasitic suppressor pl V102
R112		Same as R104.	Pl drop V103

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R113	3RC10BF122K N16–R–49940–491 3300–381016620	RESISTOR, fixed: comp; 1200 ohms, p/m 10%; 1/4 w; "F" characteristic; 0.17" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF122K	Pl filter pri Z101
R114		Same as R106.	Fil filter V103
R115	3RC20BF103K N16–R–50282–811 3300–381166160	RESISTOR, fixed: comp; 10,000 ohms, p/m 10%; 1/2 w; "F" characteristic; 11/64" diam x 13/32" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC20BF103K	Filter secd Z101
R116		Same as R105.	Filter pri Z102
R117		Same as R115.	Filter secd Z102
R118		Same as R105.	Filter pri Z103
R119	3RC10BF334K N16–R–50759–491 3300–381019020	RESISTOR, fixed: comp; 330,000 ohms; p/m 10%; 1/4 w; "F" characteristic; 0.17" diam x 0.406" lg ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF334K	GR filter secd Z103
R120		Same as R105.	Pl filter V106
R121		Same as R108.	Cath bias V107
R122		Same as R105.	Filter pri Z105
R123		Same as R115.	Filter secd Z105
R124		Same as R101.	Cath V108
R125		Same as R102.	AVC gr V108
R126	3RC10BF184J N16–R–50695–111 3300–381017660	RESISTOR, fixed: comp; 180,000 ohms, p/m 5%; 1/4 w; "F" characteristic; 0.17" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF184J	Delay bias pl V108
R127		Same as R119.	AVC filter pl V108
R128		Same as R119.	Pl load V108
R129	3RC10BF105J N16–R–50974–111 3300–381016260	RESISTOR, fixed: comp; 1.0 meg, p/m 5%; 1/4 w; "F" characteristic; 0.17" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF105J	Bias div cath V108
R130	3RC10BF682J N16–R–50200–111 3300–381020560	RESISTOR, fixed: comp; 6800 ohms, p/m 5%; 1/2 w; "F" characteristic; 11/64" diam x 13/32" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC20BF682J	Fixed bias AVC line
R131		Not Used.	
R132	3Z7425–89 N16–R–87752–5465 3300–394384126	RESISTOR, variable: Navy Type #(–631302–L20); comp; 25,000 ohms, p/m 20%; 2 w; 3 solder lug term; encl metal case 1–1/16" diam x 9/16" d; round metal shaft 1/4" diam x 5/8" lg FMS; JAN taper "A"; cont arm ins; normal torque; 3/8"–32 thd bushing 3/8" lg; AB type J. Bendix part/dwg OA219520–13	RF gain
R133	3RC10BF273J N16–R–50398–111 3300–381018520	RESISTOR, fixed: comp; 27,000 ohms, p/m 5%; 1/4 w; "F" characteristic; 0.17" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF273J	Delay bias cath V108
R134	3RC10BF822J N16–R–50236–111 3300–381021000	RESISTOR, fixed: comp; 8200 ohms, p/m 5%; 1/4 w; "F" characteristic; 0.170" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF822J	Feedback secd Z106A
R135		Same as R113.	Cath V109 secd Z106
R136		Same as R119.	Gr drop V109

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R137	3RC10BF471K N16–R–49769–491 3300–381019680	RESISTOR, fixed: comp; 470 ohms; p/m 10%; 1/4 w; "F" characteristic; 11/64" diam x 13/32" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF471K	Cath bias V109
R138		Same as R101.	Pl V109
R139		Same as R102.	AF filter gr V109
R140	3Z7499–1.119 N16–R–88342–5290 3300–399812109	RESISTOR, variable: Navy Type #(–632882–L20); comp; 1.0 meg, p/m 20%; 2w; 3 solder lug term; encl metal case 1–1/16" diam x 9/16" d; round metal shaft 1/4" diam x 5/8" lg FMS; JAN taper "A"; cont arm ins; normal torque; 3/8"–32 thd bushing 3/8" lg; AB type J. Bendix part/dwg #OA219520–14	AF gain gr V109
R141	3RC10BF683K N16–R–50552–491 3300–381020640	RESISTOR, fixed: comp; 68,000 ohms, p/m 10%; 1/4 w; "F" characteristic; 0.170" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF683K	Audio filter gr V110
R142	3RC10BF224J N16–R–50713–111 3300–381018160	RESISTOR, fixed: comp; 220,000 ohms p/m 5%; 1/4 w; "F" characteristic; 0.17" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec Jan–R–11. JAN type RC10BF224J	Bias div gr V114
R143		Same as R142.	Audio filter gr V110
R144	3RC10BF472K N16–R–50129–491 3300–381019740	RESISTOR, fixed: comp; 4700 ohms, p/m 10%; 1/4 w; "F" characteristic; 0.17" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF472K	Cath bias V108
R145		Same as R142.	Gr bias V110
R146		Same as R102.	Gr bias V110
R147		Same as R102.	Cath V110
R148		Same as R144.	Pl loading V110
R149	3RC10BF272K N16–R–50039–491 3300–381018500	RESISTOR, fixed: comp; 2700 ohms, p/m 10%; 1/4 w; "F" characteristic; 0.17" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF272K	B+ Filter pl V110
R150	3RC30BF104J N16–R–50632–751 3300–381316000	RESISTOR, fixed: comp; 100,000 ohms, p/m 5%; 1 w; "F" characteristic; 0.28" diam x 0.75" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC30BF104J	B+ div circle diam control
R151	3Z7325–47 N16–R–87422–5210 3300–394362088	RESISTOR, variable: Navy Type #(–637310–L20); comp; 2500 ohms; p/m 20%; 2 w; 3 solder lug term; encl metal case 1–1/16" diam x 9/16" d; slotted metal shaft 1/4" diam x 5/8" lg FMS, JAN taper "A"; cont arm ins; normal torque; 3/8"–32 thd bushing 1/2" lg; AB type J. Bendix part/dwg #OA219520–15	Circle diam gr V114
R152		Same as R102.	Bias gr V114
R153	3Z7499–1.118 N16–R–88342–5291 3300–399812108	RESISTOR, variable: Navy Type #(–636708–P20); comp; 1.0 meg, p/m 20%; 2 w; 3 solder lug term; encl metal case 1–1/16" diam x 9/16" d; slotted metal shaft 1/4" diam x 1" lg FMS; JAN taper "A"; cont arm ins; normal torque; 3/8"–32 thd bushing 1/4" lg; AB type J. Bendix part/dwg #OA219520–16	Bias control gr V114
R154	3RC10BF154K N16–R–50678–491 3300–331017200	RESISTOR, fixed: comp; 150,000 ohms, p/m 10%; 1/4 w; "F" characteristic; 0.17" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF154K	Bias div gr V114
R155		Not Used.	

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R156	3RC10BF342K N16–R–50093–491 3300–381019340	RESISTOR, fixed: comp; 3900 ohms, p/m 10%; 1/4 w; "F" characteristic; 0.17" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF392K	Cath V111
R157	3RC10BF563J N16–R–50515–111 3300–381020200	RESISTOR, fixed: comp; 56,000 ohms, p/m 5%; 1/4 w; "F" characteristic; 0.170" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF563J	V div gr V111
R158	3RC10BF104J N16–R–50632–111 3300–381016200	RESISTOR, fixed: comp; 100,000 ohms, p/m 5%; 1/4 w; "F" characteristic; 0.17" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF104J	V div gr V111
R159		Same as R101.	Pl drop V111
R160		Same as R119.	Pl drop V111
R161	3RC42BF224K N16–R–50715–508 3300–381603269	RESISTOR, fixed: comp; 220,000 ohms, p/m 10%; 2 w; "F" characteristic; 3/8" diam x 3/4" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC42BF224K	VR drop V115
R162	3RC42BF334K 3300–381604337	RESISTOR, fixed: comp; 330,000 ohms, p/m 10%; 2 w; "F" characteristic; 3/8" diam x 3/4" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC42BF334K	VR div V111
R163		Same as R162.	VR div scr V111
R164	3RW24359 N16–R–66029–9250 3300–385243590	RESISTOR, fixed: WW; 1,000 ohms p/m 5%; 8 w at 275°C max continuous oper temp; 1–3/4" lg x 1/2" diam less term; coating per JAN–R–26A; RSW; 2 radial tab terms; axial hole for #8 screw; spec JAN–R–26A. JAN type RW29G102	VR drop pl V112
R165		Same as R161.	
R166		Not Used.	
R167	3RA910 N16–R–89652–5301 3300–380009100	RESISTOR, variable: WW; 6 ohms, p/m 10%; 4 w at 40°C max continuous oper temp; 3 solder lug term; encl metal case 1.78" diam x 0.98" d; 1/4 "diam slotted metal shaft 1/2" lg FMS, JAN taper "A"; ins cont arm, w/o off position; normal torque; 3/8"–32 thd bushing 3/8" lg, non-turn device located on 17/32" rad at 9 o'clock; spec JAN–R–19. JAN type RA30A1SA6R0AK	Light control from T101
R168		Same as R115.	Static drain pri T104
R169		Same as R115.	Static drain pri T103
R170	N16–R–87752–5255 3300–067125302	RESISTOR, variable: comp; 25,000 ohms, p/m 20%; 2–1/4w, 70 deg C max continuous oper temp; 3 solder lug term; encl metal case 1–1/16" diam x 9/16" d; 1" lg slotted metal shaft 1/4" diam; JAN taper "A"; ins cont arm w/o off position; normal torque; 3/8–32 thd bushing 1/4" lg, non turn device at 9 o'clock, on 17/32" rad; AB type JU2532/SD2100. Bendix part/dwg #OA219520–32	Ph control pri T103
R171		Same as R113.	V drop pri T104
R172	3Z7325–46 N16–R–87422–5100 3300–394362087	RESISTOR, variable: Navy Type #(–637299–P20); comp; 2500 ohms; p/m 20%; 2 w; 3 solder lug term; encl metal case 1–1/16" diam x 9/16" d; slotted metal shaft 1/4" diam x 1" lg FMS; JAN taper "A"; cont arm ins; normal torque; 3/8"–32 thd bushing 1/4" lg; AB type J. Bendix part/dwg #OA219520–18	Horiz gain pri T103

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R173		Same as R115.	Static drain pri T104
R174		Same as R115.	Static drain pri T103
R175		Same as R144.	Ph control pri T104
R176		Same as R113.	V drop pri T103
R177		Same as R172.	Vert gain pri T104
R178	3RC41BF683K N16–R–50553–711	RESISTOR, fixed: comp; 68,000 ohms, p/m 10%; 2 w; "F" characteristic; 3/8" diam x 3/4" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC41BF683K	Sense relay drop filter secd T101
R179		Same as R178.	Sense relay drop filter secd T101
R180		Same as R178.	Sense relay drop filter secd T101
R181	3RC10BF472J N16–R–50128–111 3300–381019720	RESISTOR, fixed: comp; 4700 ohms, p/m 5%; 1/4 w; "F" characteristic; 0.17" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF472J	Bias div, suppressor V117
R182	N16–R–87522–5267 3300–067150203	RESISTOR, variable: comp; 5,000 ohms, p/m 20%; 2–1/4 w, 70 deg C max continuous oper temp; 3 solder lug term; encl metal case 1–1/16" diam x 9/16" d; 2–1/2" lg slotted metal shaft 1/4" diam; JAN taper "A"; ins cont arm w/o off position; normal torque, #3/8–32 thd x 1/4" lg bushing, non turn device located at 9 o'clock, on 17/32" rad; AB type JU5022/SD2232. Bendix part/dwg #OA219520–31	Bias control suppressor V117, 118
R183		Same as R181.	Bias div suppressor V118
R184	3RC10BF393J N16–R–50443–111 3300–381019360	RESISTOR, fixed: comp; 39,000 ohms, p/m 5%; 1/4 w; "F" characteristic; 0.17" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF393J	Suppressor bias div V117
R185		Same as R184.	Suppressor bias V118
R186		Same as R181.	Bias div, suppressor V119
R187		Same as R182.	Bias control suppressor V119, 120
R188		Same as R181.	Bias div suppressor V120
R189		Same as R184.	Suppressor bias V119
R190		Same as R184.	Suppressor bias V120
R191	3Z7450–139 N16–R–87852–5521 3300–399809084	RESISTOR, variable: Navy Type #(–637301–20); comp; 50,000 ohms, p/m 20%; 2 w; 3 solder lug term; encl metal case 1–1/16" diam x 9/16" d; slotted metal shaft 1/4" diam x 4–1/2" lg FMS; JAN taper "A"; cont arm ins; normal torque; 3/8"–32 thd bushing 3/8" lg; AB type JU5032/SD3432. Bendix part/dwg #OA219520–29	Vert symmetry V117, 118

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R192		Same as R191.	Horiz symmetry V119, 120
R193	3Z7425–90 N16–R–87752–5265 3300–394384127	RESISTOR, variable: Navy Type #(–637302–20); comp; 25,000 ohms, p/m 20%; 2 w; 3 solder lug term; encl metal case 1–1/16" diam x 9/16" d slotted metal shaft 1/4" diam x 4–1/2" lg FMS; JAN taper "A"; cont arm ins; normal torque; 3/8"–32 thd bushing 3/8" lg; AB type JU2532/SD3432. Bendix part/dwg #OA219520–30	Bias div horiz & vert symmetry
R194		Same as R102.	Cath V114
R195		Same as R119.	Gr bias V117
R196		Same as R119.	Gr bias V118
R197		Same as R119.	Gr bias V119
R198		Same as R119.	Gr bias V120
R199	N16–R–87352–5380 3300–067110206	RESISTOR, variable: comp; 1000 ohms, p/m 20%; 2–1/4 w, 70 deg C max continuous oper temp; 3 solder lug term; encl metal case 1–3/32" diam x 9/16" d; 5/8" lg slotted metal shaft 1/4" diam; JAN taper "A"; ins cont arm w/o off position; normal torque; 3/8"–32 thd x 1/2" lg bushing, non turn device located at 9 o'clock on 17/32" rad; AB type JU1022/-SD4040. Bendix part/dwg #OA219520–33	Vert cath V119, 120
R200		Same as R199.	Horiz cath V117, 118
R201	3RC30BF152K N16–R–49968–231 3300–381317080	RESISTOR, fixed: comp; 1500 ohms, p/m 10%; 1 w; "F" characteristic; 9/32" diam x 3/4" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC30BF152K	Cath V117
R202		Same as R201.	Cath V118
R203		Same as R201.	Cath V119
R204		Same as R201.	Cath V120
R205		Same as R150.	Pl V117
R206		Same as R150.	Pl V118
R207		Same as R150.	Pl V119
R208		Same as R150.	Pl V120
R209		Same as R119.	V div gr V121
R210		Same as R119.	V div gr V121
R211		Same as R119.	V div gr V121
R212		Same as R119.	V div gr V121
R213	3RC10BF274K N16–R–50741–491 3300–381018580	RESISTOR, fixed: comp; 270,000 ohms, p/m 10%; 1/4 w; "F" characteristic; 0.170" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF274K	Gr drop V121
R214		Same as R213.	Gr drop V121
R215		Same as R119.	Pl drop V121
R216		Same as R119.	Pl drop V121
R217	3RC30BF472J N16–R–50128–751 3300–381319720	RESISTOR, fixed: comp; 4700 ohms, p/m 5%; 1 w; "F" characteristic; 9/32" diam x 3/4" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC30BF472J	Cath V123
R218		Same as R217.	Cath V123
R219		Same as R217.	Cath V124
R220		Same as R217.	Cath V124
R221	3RC30BF683J N16–R–50551–751 3300–381320620	RESISTOR, fixed: comp; 68,000 ohms, p/m 5%; 1 w; "F" characteristic; 9/32" diam x 3/4" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC30BF683J	Horiz deflection pl drop V123

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS: SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R222	3Z7425–91 N16–R–87752–5260 3300–394384128	RESISTOR, variable: Navy Type #(–637300–20); comp; 25,000 ohms, p/m 20%; 2 w; 3 solder lug term; encl metal case 1–1/16" diam x 9/16" d; slotted metal shaft 1/4" diam x 3" lg FMS; JAN taper "A"; cont arm ins; normal torque; 3/8"–32 thd bushing 1/4" lg; AB type JU2532/SD2300. Bendix part/dwg #OA219520–20	Horiz ctr pl V123
R223		Same as R221.	Horiz deflection pl drop V123
R224		Same as R221.	Vert deflection pl drop V124
R225		Same as R222.	Vert ctr, pl V124
R226		Same as R221.	Vert drop V124
R227	3RC30BF334K N16–R–50760–0231 3300–381319020	RESISTOR, fixed: comp; 330,000 ohms, p/m 10%; 1 w; F characteristic; 9/32" diam x 3/4" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC30BF334K	V div focus anode V127
R228	3Z7498–25.90 N16–R–88082–5267 3300–399811570	RESISTOR, variable: Navy Type #(–632061–L20); comp; 250,000 ohms; p/m 20%; 2 w; 3 solder lug term; encl metal case 1–1/16" diam x 9/16" d; round metal shaft 1/4" diam x 5/8" lg FMS; JAN taper "A"; cont arm ins; normal torque; 3/8"–32 thd bushing 3/8" lg; AB type JU2542/P3040. Bendix part/dwg #OA219520–21	Focus anode V127
R229	3RC30BF224K N16–R–93082–3701 3300–381318180	RESISTOR, fixed: comp; 220,000 ohms, p/m 10%; 1 w; "F" characteristic; 9/32" diam x 3/4" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC30BF224K	V div, secd T102
R230	3Z7450–138 N16–R–87852–5370 3300–399809083	RESISTOR, variable: Navy Type #(–631234–M20); comp; 50,000 ohms, p/m 20%; 2 w; 3 solder lug term; encl metal case 1–1/16" diam x 9/16" d; round metal shaft 1/4" diam x 3/4" lg FMS; JAN taper "A"; cont arm ins normal torque; 3/8"–32 thd bushing 3/8" lg; AB type JU5032/P2048. Bendix part/dwg #OA219520–22	Brilliancy gr V127
R231		Same as R154.	V div anode #2 V127
R232	3RC10BF184K N16–R–50696–491 3300–381017680	RESISTOR, fixed: comp; 180,000 ohms, p/m 10%; 1/4 w; "F" characteristic; 0.170" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC10BF184K	V div anode #2 V127
R233	3RC30BF823K N16–R–50589–231 3300–233321060	RESISTOR, fixed: comp; 82,000 ohms, p/m 10%; 1 w; "F" characteristic; 0.28" diam x 0.75" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN–R–11. JAN type RC30BF823K	Filter, secd T102
R234		Same as R233.	Filter, secd T102
R235	3RC42BF154K N16–R–50679–520 3300–381602006	RESISTOR, fixed: comp; 50,000 ohms, p/m 10%; 2 w; "F" characteristic; 3/8" diam x 3/4" lg; ins, RSW and humidity; 2 axial wire leads; spec JAN–R–11. JAN type RC42BF154K	Filter, secd T102
R236		Same as R115.	Fil ctr tap V122
R237		Same as R115.	Fil ctr tap V122
R238	3Z6925–2.1 N16–R–85001–4995 3300–394184101	RESISTOR, thermal: 0.168 to 0.185 amp, 0.8 w; v drop 4.8 to 8.6 v; AC; T9 bulb 2–5/8" lg o/a; octal base mtg; pin term; Amperite #1H–4B. Bendix part/dwg #C222843	V102 fil constant v

TABLE 8-4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD-2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
R239	3RC10BF123J N16-R-50308-111 3300-381016640	RESISTOR, fixed: comp; 12,000 ohms, p/m 5%; 1/4 w; "F" characteristic; 0.170" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN-R-11. JAN type RC10BF123J	AVC filter
R240		Same as R110.	Cath loading V103
R241	3RC10BF101J N16-R-49579-111 3300-381016000	RESISTOR, fixed: comp; 1000 ohms, p/m 5%; 1/4 w; "F" characteristic; 0.170" diam x 0.406" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN-R-11. JAN type RC10BF101J	Scr drop V112
R242		Same as R235.	Filter, secd T102
R243		Same as R129.	Bias control V117, V118
R244		Same as R129.	Bias control V119, V120
R301	3RC20BF273K N16-R-50399-811 3300-381168540	RESISTOR, fixed: comp; 27,000 ohms, p/m 10%; 1/2 w; "F" characteristic; 11/64" diam x 13/32" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN-R-11. JAN type RC20BF273K	Gr V301
R302	3RC20BF104K N16-R-50633-0811 3300-381166220	RESISTOR, fixed: comp; 100,000 ohms, p/m 10%; 1/2 w; "F" characteristic; 11/64" diam x 13/32" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN-R-11. JAN type RC20BF104K	Gr V301
R303	3RC20BF751J N16-R-49858-431	RESISTOR, fixed: comp; 750 ohms, p/m 5%; 1/2 w; "F" characteristic; 11/64" diam x 13/32" lg; ins; RSW and humidity; 2 axial wire leads; spec JAN-R-11. JAN type RC20BF751J	Shunt M301
R401		Same as R241.	Antenna Phasing
R402		Same as R241.	Antenna Phasing
R403		Same as R241.	Antenna Phasing
R404		Same as R241.	Antenna Phasing
R405	3RC10BF560K N16-R-49463-491 3300-381020100	RESISTOR, fixed: comp; 56 ohms, p/m 10%; 1/4 w; "F" characteristic; 11/64" diam x 13/32" lg; ins, RSW and humidity; 2 axial wire lead term; spec JAN-R-11. JAN type RC10BF560K	Sense phasing
R406		Same as R241.	Sense phasing
S101	3Z9580-16.2 N17-S-55304-4140 3360-395050427	SWITCH, lever: Navy Type #(-241423); position #1 locking, 2C; position #2 non-locking, 5C; cont rating 1/2 amp, 24 v AC; phenolic ins; 3-3/16" lg x 23/32" wd x 1.253" h; 1-3/16" lg handle; solder lug term; four #2-56 thd holes on 35/64" x 13/16" mtg/c; Kellogg Type #1000. Bendix part/dwg #C218164-3	Sense calibrate sw, oper from J104
S102	3Z9863-10A N17-S-70638-6577 3360-395852376	SWITCH, toggle: SPST; 1.5 amp, 125 v AC; molded bakelite body; 1-1/32" h x 9/16" wd x 51/64" d; 11/16" lg handle; solder term; single hole mtg, 15/32"-32 thd x 15/32" lg bushing; spec JAN-S-23. JAN type ST10A	Power ON-OFF
S103		Same as S102.	B401 ON-OFF

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
S104	3Z9509–1 N17–S–57687–8129 3360–395006000	SWITCH, push: Navy Type #(–24212); DPST; phenolic body; 1–9/16" lg x 5/8" wd x 9/16" d o/a approx; momentary action, normally open; solder lug term; single hole mtg, 15/32"–32 thd bushing 19/32" lg; AH&H similar to #3594–D. Bendix part/dwg #A29843–1	HV interlock, pri T102
S301	3Z9825–65.71 N17–S–61052–5001 3360–395500818	SWITCH, rotary: 2 pole, 3 position; 1 sect; silver cont; phenolic body; 1–7/8" h x 1–33/64" wd x 3/4" d; solder lug term; single hole mtg, bushing 3/8"–32 thd x 1/4" lg; flatted shaft 1/4" diam x 1.2" lg FMS; Oak Type H. Bendix part/dwg #C218145–75	ON-OFF
T101	2Z9613.684 N17–T–74308–7298 3340–296912620	TRANSFORMER, power: Navy Type #(–304861); fil and plate; input 115 v, 60 cyc, 100 va, single ph; 5 output wnd; secd #1 5v, 2 amp; secd #2 770v, 0.090 amp, DC CT; secd #3 13v, 0.2 amp, tapped at 3 v, 1 amp, tapped at 6.3v, 3.55 amp; secd #4 6.3v, 1.55 amp; secd #5 6.3v, 0.6 amp; ins v 2500 all wnd; varnish impr and potted; HS metal case; 5" h less term x 3–3/4" wd x 4.06" lg; 15 solder ins term on bottom; four 1/4"–20 thd studs 0.40" lg on 3" x 2–3/4" mtg/c; electrostatic shield between pri and secd. Bendix part/dwg #C217128	Power transf drives V113
T102	2Z9612–229 N17–T–73951–9461 3340–296889169	TRANSFORMER, power: Navy Type #(–303451); fil and plate; input 110 v, 60 cyc, 9 va, single ph; 3 output wnd; secd #1 1.25v, 0.2 amp; secd #2 6.3v, 0.6 amp; secd #3 2000 v, 0.001 amp DC half-wave; ins v 1500 pri/1500 secd #1/5000 secd #2/5000 secd #3; varnish impr and potted; HS metal case; 3–1/2" h less term x 2–13/16" sq; 4 solder ins term on bottom and 4 on top; four #10–32 thd studs 13/32" lg on 2–1/16" sq mtg/c. Bendix part/dwg #C213000	Scope transf drives V128
T103	2Z9631.395 N17–T–62599–2016 3340–296979215	TRANSFORMER, AF: Navy Type #(–304860); input; pri 1000 ohms impedance; secd #1, 250 ohms impedance, secd #2, 250 ohms impedance; copper HS case, laminated iron core; 3" h less term x 1.88" lg x 1.44" wd; 0 db level; turns ratio of pri to ea secd 2 to 1; varnish impr and potted; freq response 30 cyc only; electrostatic shield between pri and secd; 6 solder ins term on bottom; four #6–32 tapped holes 1/4" d on 1" x 1–3/8" mtg/c. Bendix part/dwg #A217126	Audio transf drives V117, 118
T104		Same as T103.	Audio transf drives V119, 120
T301	2Z9634.138 N16–R–29661–4532 3340–297031801	REACTOR: Navy Type #(–304652); modulation choke; inductance term #1 & #4 is 4 hy; 890 ohms DC resistance at 20°C; 1500 v RMS test; 1–3/4" h less term x 1.175" sq; turns ratio term #1 & #2 to #2 & #4 is 1:1, turns ratio term #1 & #3 to #3 & #4 is 1.67:1; varnish impr and potted in HS metal case; 4 solder lug term on bottom; 2 #6–32 thd x 0.21" lg studs on 3/4" mtg/c. Bendix part/dwg #A217054	Modulation
V101	2J6AS6 N16–T–56201 3300–234454100	TUBE, electron: dual control RF pent, sharp cut-off receiving. JAN type 6AS6	RF amplr
V102		Same as V101.	Osc.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
V103	2J2C51 N16–T–52351 3300–234190475	TUBE, electron: twin triode. JAN type #2C51	Mixer
V104		Same as V101.	1st IF amplr
V105		Same as V101.	2nd IF amplr
V106		Same as V101.	3rd IF amplr
V107		Same as V101.	4th IF amplr
V108		Same as V103.	Det & AVC
V109		Same as V103.	Aud amplr
V110		Same as V103.	Noise amplr & rect
V111		Same as V103.	VR amplr
V112	2J6Y6G N16–T–56916 3300–234820000	TUBE, electron: beam power amplr. JAN type 6Y6G	VR
V113	2J5R4GY N16–T–55444 3300–234355000	TUBE, electron: receiving duo diode rect. JAN type 5R4GY	LV rectifier
V114		Same as V103.	Cath fol
V115	2J0C3/VR105 N16–T–53050 3300–234006500	TUBE, electron: v regulator. JAN type OC3/VR105	VR
V116	2J0A3/VR75 N16–T–53030 3300–234005500	TUBE, electron: diode V regulator. JAN type OA3/VR75	VR
V117		Same as V101.	Circle mod
V118		Same as V101.	Circle mod
V119		Same as V101.	Circle mod
V120		Same as V101.	Circle mod
V121		Same as V103.	Horiz VR
V122		Same as V103.	Vert VR
V123		Same as V103.	Circle amplr (horiz)
V124		Same as V103.	Circle amplr (vert)
V125	2J5651 N16–T–75651 3300–235793280	TUBE, electron: VR. JAN type 5651	VR
V126		Same as V125.	VR
V127	2J5CP1A N16–T–55132 3300–234330002	TUBE, electron: electrostatic deflection and focus CR tube. JAN type 5CP1A	CRT
V128	2J1B3GT N16–T–51203 3300–234024580	TUBE, electron: transmitting diode vacuum rect. JAN type 1B3GT	HV rect
V301	2J3A5 N16–T–53150 3300–234220000	TUBE, electron: JAN type 3A5	RF osc
W401	2Z4885–218 *N17–C–66951–1201 1700–291643517	CONDUIT ASSEMBLY: conduit for sense relay lead; c/o section RG–52/U, terminated at one end w/ bracket; Bendix #A244022 and other end w/ solder lug, Bendix #A243318–6; 1/2" h x 1" wd x 29–1/2" lg; bkt w/ 2 sets 0.177" diam holes for mtg. Bendix part/dwg #L203806–2	Conduit for sense relay lead

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
W402	2Z7390–52 N16–T–25301–1161 1700–294732317	TRANSMISSION LINE SECTION: transf bal to un-bal; c/o 29–1/2″ lg #RG–52/U tubing w/2 int conductors & 3 supports, input & output impedance 50 ohm, freq range 100–156 mc; 29–1/2″ lg x 1″ h x 1/2″ wd x 0.050″ thk wall; brass, ocean gray exterior; bracket w/ two 0.177″ diam holes on 1–1/2″ mtg/c. Bendix part/dwg #C203807–1	transf unbal
W501	3E6015–92A *N16–C–11613–1029 1700–322850471	CABLE ASSEMBLY, RF: AN type #CG–92A/U (100′–0″); uses JAN cable RG–9/U; exposed cable 99–2/3 ft lg less terminations; 100 ft lg o/a plug JAN type UG–21B/U both ends. Bendix part/dwg #L223520–1	R–256A/URD–2 to AS–410/–URD–2 incl P101 and P401
W502	3E7350.1–1193 *N17–C–48783–5435 1700–322863255	CABLE ASSEMBLY, power: Navy Type #(–62445)(100′–0″); uses TTRS–4 cable, 4 shielded pr #22 AWG stranded copper cond; 99 ft, 5–1/4″ exposed cable less terminations; 100 ft lg o/a; plug NT #AN3106–20–7PA(101W–6–1) one end, plug NT #AN3106–20–7SA(101W–6–1) other end. Bendix part/dwg #N223521–1	R–256A/URD–2 to AS–410/–URD–2 incl P104 and P402
W503	3E7350.1–141 *N16–C–48253–4291 1700–322853218	CABLE ASSEMBLY, power: Navy Type #(–42446)(12′–0″); uses Underwriters' type "S", 2 #14 AWG stranded cond, 600 v working; 12 ft lg o/a; terminated one end by ANA plug AN3106A–22–4S, other end by plug 491697. Bendix part/dwg #C212526–3	Power cable incl P103 and P106
X101	——— N16–S–62603–6695 8850–883600	SOCKET, tube: 7 cont miniature; one piece saddle mtg; two 1/8″ diam holes on 7/8″ mtg/c; round ceramic body, 51/64″ diam x 25/32″ h less cont; beryllium copper, silver pl cont; marked w/ pin numbers; w/ metal shock shield and ctr shield; Elco #238BC. Bendix part/dwg #C287037–2	For V101 (RF amplr)
X102		Same as X101.	For V102 (osc)
X103	——— N16–S–64603–6718 8850–896279	SOCKET, tube: Navy Type #(–491853); 9 cont miniature; one piece saddle mtg; two 1/8″ diam holes on 1–1/8″ mtg/c; oval mica filled phenolic body 0.940″ diam x 1–1/8″ h o/a; beryllium copper, silver pl cont; w/ctr shield 0.165″ ID. Bendix part/dwg #C223218–1	For V103 Mixer
X104		Same as X101.	For V104 (1st IF)
X105		Same as X101.	For V105 (2nd IF)
X106		Same as X101.	For V106 (3rd IF)
X107		Same as X101.	For V107 (4th IF)
X108		Same as X103.	For V108 (det & AVC)
X109		Same as X103.	For V109 (audio amplr)
X110		Same as X103.	For V110 (noise amplr & det)
X111		Same as X103.	For V111 (VR amplr)
X112	——— N16–S–63516–6551 8850–891980	SOCKET, tube: Navy Type #(–49374A); octal; one piece saddle mtg; two 5/32″ diam holes on 1–1/2″ mtg/c; molded phenolic body, 1–1/8″ diam x 0.483″ h excluding term; phosphor bronze, silver pl cont; Amphenol #MIP–8TM. Bendix part/dwg #A113017–6	For V112 (VR)

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
X113		Same as X112.	For V113 (LV rect)
X114		Same as X103.	For V114 (cath fol)
X115		Same as X112.	For V115 (VR)
X116		Same as X112.	For V116 (VR)
X117		Same as X101.	For V117 (circle mod)
X118		Same as X101.	For V118 (circle mod)
X119		Same as X101.	For V119 (circle mod)
X120		Same as X101.	For V120 (circle mod)
X121		Same as X103.	For V121 (VR horiz)
X122		Same as X103.	For V122 (VR vert)
X123		Same as X103.	For V123 (horiz amplr)
X124		Same as X103.	For V124 (vert amplr)
X125		Same as X101.	For V125 (VR)
X126		Same as X101.	For V126 (VR)
X127	——— N16–S–64378–3782 8850–897615	SOCKET, tube: Navy Type #(–49920); 14 cont diheptal; requires mtg bkt; round phenolic body 2–7/32" OD x 1–1/8" thk o/a; phosphor bronze, cad pl cont; Cinch #9453–1FV. Bendix part/dwg #C65510	For V127 (CRT)
X128		Same as X112.	For 128 (HV rect)
X129		Same as X112.	For R238 (ballast)
X130	3Z3275 N17–F–74267–5401 8800–619703	FUSEHOLDER: extractor post type; for one 3AG fuse; bakelite body; 2–7/32" lg x 23/32" diam o/a; 1/2" diam thd for panel hole mtg; solder lug term; Littelfuse #342001. Bendix part/dwg #A30003	For F101
X131	——— N17–L–51632–6957 8850–776598	LAMPHOLDER: miniature bayonet; brass, nickel pl body; 28 v; approx 13/16" lg x 5/8" wd x 1–31/32" h o/a; mtg bkt w/ slot 3/4" lg x 3/16" wd; 2 solder lug term; Amer Rad Hdwe #1539. Bendix part/dwg #A104910	For I101
X132	N17–C–80686–6626	CONTACT, lampholder: alidade lamp contact; c/o ins and contact; irregular shape; 2" lg x 7/16" wd x 1/2" thk; two 1/8" diam holes spaced 1–19/32" c to c. Bendix part/dwg #C208174–1	For I102
X133		Same as X132.	For I103
X134		Same as X132.	For I104
X301		Same as X101.	For V301
Z101	2Z9643.358 N17–T–68062–2662 3340–297070071	TRANSFORMER, IF: Navy Type #(–472478); 12 mc; input; shielded; approx 1.954" lg x 1.492" wd x 3–5/8" h less term & adj studs; iron core; double tuned; adj iron core tuning; two #6–32 thd mtg studs 5/16" lg on 1.808" mtg/c; 4 solder lug term on bottom. Bendix part/dwg #L203653–1	Mixed IF

TABLE 8–4. TABLE OF REPLACEABLE PARTS—(Continued)

AN/URD–2A DIRECTION FINDER SET

REF. DESIG.	STOCK NUMBERS SIGNAL CORPS STANDARD NAVY AIR FORCE	NAME OF PART AND DESCRIPTION	LOCATING FUNCTION
Z102	2Z9643.357 N17–T–68062–2643 3340–297070070	TRANSFORMER, IF: Navy Type #(–472479); 12 mc; interstage, 1st or 2nd IF; shielded approx 1.954" lg x 1.492" wd x 3–5/8" h less term & adj studs; iron core; double tuned; adj iron core tuning; two #6–32 thd studs 5/16" lg on 1.808" mtg/c; 4 solder lug term on bottom. Bendix part/dwg #L203654–1	1st IF
Z103		Same as Z102.	2nd IF
Z104	2Z9643.359 N17–T–68062–2641 3340–297070072	TRANSFORMER, IF: Navy Type #(–472480); 12 mc; interstage, 3rd IF; shielded; 1.954" lg x 1.492" wd x 3–5/8" h less term & adj studs; iron core; double tuned; adj iron core tuning; two #6–32 thd mtg studs 5/16" lg on 1.808" mtg/c; 4 solder lug term on bottom. Bendix part/dwg #L203654–2	3rd IF
Z105	2Z9643.356 N17–T–68062–2647 3340–297070069	TRANSFORMER, IF: Navy Type #(–472481); 12 mc; output; shielded; approx 1.954" lg x 1.492" wd x 3–5/8" h less term & adj studs; iron core; double tuned; adj iron core tuning two #6–32 thd mtg studs 5/16" lg on 1.808" mtg/c; 4 solder lug term on bottom. Bendix part/dwg #L203654–3	4th IF
Z106	2Z9643.108 N16–F–32195–7693 3340–297031771	FILTER, bandpass: Navy Type #(–303452); c/o plate coupling type AF transf and reactor in one case; pri impedance 15,000 ohms, 0.010 amp DC, secd impedance 600 ohms; HS metal case, iron laminations; 3–1/2" h less term x 1–7/8" lg x 1–7/16" wd; 0.2 w level; turns ratio pri to secd 5 to 1; freq response 300 to 4000 cyc 2 db; 6 solder lug ins term on bottom; four #6–32 tapped holes 1/4" d on 1" x 1–3/8" mtg/c; reactor 5 hy, 0.045 amp DC, 350 ohms resistance. Bendix part/dwg #A213004	Audio output transf & filter choke
BT301	——— N17–B–58789–6097 8800	BATTERY, dry: 1–1/2 v; sq; 2–9/16" sq x 4" h; non-metallic case; 2 socket term. JAN type BA–65	1–1/2 v
BT302	——— N17–B–59939–4304 8800	BATTERY, dry: 45 v; rectangular; 2–15/16" lg x 2–1/4" wd x 4–1/16" h; non-metallic case; 3 socket term. JAN type BA–63	45 v supply
BT303		Same as BT302.	45 v supply
BT304		Same as BT302.	45 v supply

TABLE 8–5. MAINTENANCE PARTS KIT

KEY SYMBOL	NAVY		AIR FORCE		KEY SYMBOL	NAVY		AIR FORCE	
	BOX NO.	QUANTITY	BOX NO.	QUANTITY		BOX NO.	QUANTITY	BOX NO.	QUANTITY
A102		1	—	—	R115	—	—		2
B401		1		1	R119	—	—		3
C102	—	—		1	R129	—	—		1
C103	—	—		1	R126	—	—		1
C109	—	—		1	R130	—	—		1
C112	—	—		1	R133	—	—		1
C114	—	—		1	R134	—	—		1
C115	—	—		1	R137	—	—		1
C118	—	—		2	R141	—	—		1
C133	—	—		1	R142	—	—		1
C137	—	—		1	R144	—	—		1
C142	—	—		1	R149	—	—		1
C143	—	—		1	R150	—	—		1
C144	—	—		1	R154	—	—		1
C157	—	—		1	R157	—	—		1
C160	—	—		1	R158	—	—		1
C162	—	—		1	R161	—	—		1
C172	—	—		1	R162	—	—		1
C175	—	—		1	R164	—	—		1
C181A, B		1		1	R178	—	—		1
C182	—	—		1	R181	—	—		1
C302	—	—		1	R184	—	—		1
C304	—	—		1	R201	—	—		1
C305	—	—		1	R213	—	—		1
C308	—	—		1	R217	—	—		1
C404		1	—	—	R221	—	—		1
C405	—	—		1	R227	—	—		1
E301		1		1	R229	—	—		1
E305		1	—	—	R232	—	—		1
E403		1	—	—	R233	—	—		1
E405		1		1	R235	—	—		1
E406		2		1	R238	—	—		1
E408		1		1	R239	—	—		1
E409		1		1	R241	—	—		1
E410		4		1	R301	—	—		1
E414		1		1	R302	—	—		1
E415		2		1	R405	—	—		1
E417		4		1	S301		1	—	—
E421		4		1	T101		1	—	—
E425		1		1	T102		1	—	—
E426		8		1	T103		1	—	—
E434		1		1	T301		1	—	—
E444		1		1	V101	—	—		15
E450	—	—		2	V103	—	—		20
F101	—	—		2	V112	—	—		2
I101	—	—		2	V113	—	—		2
I102	—	—		3	V115	—	—		2
K401		1	—	—	V116	—	—		2
O137		2	—	—	V125	—	—		4
O401		1		1	V127	—	—		1
O402		1		1	V128	—	—		2
R101	—	—		1	V301	—	—		2
R102	—	—		1	X132		2	—	—
R104	—	—		1	Z101		1	—	—
R105	—	—		1	Z102		2	—	—
R106	—	—		1	Z104		1	—	—
R108	—	—		1	Z105		1	—	—
R109	—	—		1	Z106		1	—	—
R110	—	—		1					
R111	—	—		1					
R113	—	—		1					

TABLE 8–6. CROSS REFERENCE PARTS LIST

JAN DESIGNATION	KEY SYMBOL
BA–63	BT302
BA–65	BT301
CC21CH100D	C109
CC21SL470K	C102
CC21UK050D	C144
CC21UK150J	C114
CC21UK150K	C112
CC21UK1R5D	C403
CM20C330J	C143
CM20C560C	C137
CM20C680G	C115
CM35A682K	C160
CM35B472M	C118
CM35B822J	C157
CN43E204K	C133
CP07SA2	H107
CP41B1DF405V	C172
CP53B1EB105K	C175
CP54B1EE504X	C182
JJ034	J102
MR25W200DCUA	M301
RA30A1SA6R0AK	R167
RC10BF100K	R111
RC10BF101J	R241
RC10BF103K	R110
RC10BF104J	R158
RC10BF104K	R101
RC10BF105J	R129
RC10BF105K	R102
RC10BF122K	R113
RC10BF123J	R239
RC10BF154K	R154
RC10BF184J	R126
RC10BF184K	R232
RC10BF221K	R106
RC10BF224J	R142
RC10BF224K	R154
RC10BF271K	R108
RC10BF272K	R149
RC10BF273J	R133
RC10BF274K	R213
RC10BF334K	R119
RC10BF392K	R156
RC10BF393J	R184
RC10BF471K	R137
RC10BF472J	R181
RC10BF472K	R144
RC10BF560K	R405
RC10BF563J	R157
RC10BF682J	R130
RC10BF683K	R141
RC10BF822J	R134
RC20BF103K	R115
RC20BF104K	R302
RC20BF273K	R301
RC20BF751J	R303
RC30BF104J	R150
RC30BF152K	R201
RC30BF223K	R104
RC30BF224K	R229
RC30BF334K	R227
RC30BF472J	R217
RC30BF683J	R221
RC30BF823K	R233
RC41BF683K	R178
RC42BF123K	R109
RC42BF154K	R235
RC42BF224K	R161
RC42BF334K	R162
RC42BF822K	R105
RW29G102	R164
TS102U01	E113
TS102U02	E120
TS103U01	E109
OA3/VR75	V116
OC3/VR105	V115
1B3GT	V128
2C51	V103
3A5	V301
5CP1A	V127
5R4GY	V113
6AS6	V101
6Y6G	V112
5651	V125

AN TYPE	KEY SYMBOL
CG–92A/U	W501
UG–21B/U	P101
UG–538/U	J401

MIL TYPE	KEY SYMBOL
AN3102A–20–7P	J402
AN3102A–20–7S	J104
AN3102A–22–4P	J103
AN3106A–22–4S	P103

NAVY TYPE	KEY SYMBOL
–10610	A301
–10662	A405
–10666	I301
–24212	S104
–28032–3	F101
–49374A	X112
–49496	H102
–49679	H101
–49680	H103
–49920	X127
–61166	E107
–62445 (100′ 0″)	W502
–62446 (12′ 0″)	W503
–212031	G401
–212032	B401
–241423	S101
–291766	K401
–303451	T102
–303452	Z106
–303453	L107
–304652	T301
–304860	T103
–304861	T101
–471660	L105
–472478	Z101
–472479	Z102
–472480	Z104
–472481	Z105
–483953–10	C181A, B
–484093–10	C142
–484833–20	C103
–484834–E20	C305
–484949	C111
–484950	C101A, B, C
–484952–20	C162
–484953–10	C405
–484955	C404
–491697	P106
–491853	X103
–491865	P301
–491866	P302
–631234–M20	R230
–631302–L20	R132
–632061–L20	R228
–632882–L20	R140
–636708–P20	R153
–637300–20	R222
–637301–20	R191
–637302–20	R193
–637310–L20	R151

STANDARD NAVY STOCK NUMBER	KEY SYMBOL
F16–R–33591–1189	E151
G41–W–2449	H405
G43–S–17350	H403
N16–A–22224–1001	O301
N16–A–51082–1266	E301
N16–A–61925–6367	E417
N16–A–61933–6113	E421
N16–A–61945–7246	E425
N16–A–70501–1023	E445
N16–A–70501–1036	E445A
N16–B–150221–130	A404
N16–C–11613–1029	W501
N16–C–15404–7900	C403
N16–C–15629–2694	C144
N16–C–15915–9167	C109
N16–C–15989–1581	C114
N16–C–15998–6081	C112
N16–C–16541–7014	C102
N16–C–17923–8022	C162

TABLE 8-6. CROSS REFERENCE PARTS LIST—(Continued)

STANDARD NAVY STOCK NUMBER	KEY SYMBOL	STANDARD NAVY STOCK NUMBER	KEY SYMBOL	STANDARD NAVY STOCK NUMBER	KEY SYMBOL	STANDARD NAVY STOCK NUMBER	KEY SYMBOL
N16-C-18179-8022	C103	N16-G-433214-592	O105	N16-R-50551-751	R221	N16-S-35194-1193	E132
N16-C-25102-6281	C302	N16-G-435003-151	O104	N16-R-50552-491	R141	N16-S-62603-6695	X101
N16-C-26843-5550	C304	N16-G-500001-273	O103	N16-R-50559-711	R178	N16-S-63516-6551	X112
N16-C-27181-4401	C143	N16-G-500001-308	O136	N16-R-50589-231	R233	N16-S-64378-3782	X127
N16-C-27756-5721	C137	N16-G-500001-338	O115	N16-R-50632-111	R158	N16-S-64603-6718	X103
N16-C-27993-9321	C115	N16-H-800001-193	A403	N16-R-50632-751	R150	N16-S-117101-292	N101
N16-C-30172-4381	C305	N16-H-800001-211	A101	N16-R-50633-491	R101	N16-S-117101-515	N102
N16-C-31095-6688	C170	N16-K-700065-901	E303	N16-R-50633-0811	R302	N16-S-685341-107	O106
N16-C-32651-9288	C118	N16-K-700266-501	E124	N16-R-50678-491	R154	N16-S-850281-143	A401
N16-C-33068-5818	C160	N16-K-700266-744	E133	N16-R-50679-520	R235	N16-S-850281-146	A401-1
N16-C-33274-5543	C157	N16-K-700418-786	E127	N16-R-50695-111	R126	N16-T-25301-1161	W402
N16-C-42729-9769	C308	N16-M-58382-6701	A402	N16-R-50696-491	R232	N16-T-25301-1255	E446
N16-C-44249-4760	C142	N16-M-60909-7976	H107	N16-R-50713-111	R142	N16-T-51203	V128
N16-C-46150-9760	C133	N16-M-150299-875	A405	N16-R-50715-508	R161	N16-T-52351	V103
N16-C-47335-6210	C182	N16-P-29153-1868	L107	N16-R-50741-491	R213	N16-T-53030	V116
N16-C-48253-4291	W503	N16-P-401881-185	E450	N16-R-50759-491	R119	N16-T-53050	V115
N16-C-48808-9150	C175	N16-R-29661-4532	T301	N16-R-50760-0231	R227	N16-T-55132	V127
N16-C-49578-2076	C405	N16-R-33591-1258	E151	N16-R-50974-111	R129	N16-T-55444	V113
N16-C-49981-9993	C172	N16-R-49238-491	R111	N16-R-50975-491	R102	N16-T-56201	V101
N16-C-52992-7087	C181A & B	N16-R-49463-491	R405	N16-R-66029-9250	R164	N16-T-56916	V112
N16-C-57613-6640	C404	N16-R-49579-111	R241	N16-R-85001-4995	R238	N16-T-53150	V301
N16-C-62299-4354	C111	N16-R-49661-491	R106	N16-R-87352-5380	R199	N16-T-75651	V125
N16-C-63458-8201	C401A, B, C, D, E, F	N16-R-49688-491	R108	N16-R-87422-5100	R172	N16-T-802001-108	A301
		N16-R-49769-491	R137	N16-R-87422-5210	R151	N16-V-300651-726	A102
N16-C-63671-2868	C101A, B, C	N16-R-49858-431	R303	N16-R-87522-5267	R182	N16-W-180001-254	E444
N16-C-71576-1001	E403	N16-R-49940-491	R113	N16-R-87752-5255	R170	N17-A-36191-1002	J401
N16-C-71597-6090	L302	N16-R-49968-231	R201	N16-R-87752-5260	R222	N17-B-58789-6097	BT301
N16-C-71656-2054	L101	N16-R-50039-491	R149	N16-R-87752-5265	R193	N17-B-59939-4304	BT302
N16-C-71656-6005	L301	N16-R-50093-491	R156	N16-R-87752-5465	R132	N17-B-77482-7682	E153
N16-C-71656-7209	L102	N16-R-50128-111	R181	N16-R-87852-5370	R230	N17-B-77484-8225	E402
N16-C-72556-4604	L106	N16-R-50128-751	R217	N16-R-87852-5521	R191	N17-B-77743-3500	E139
N16-C-72577-3769	L118	N16-R-50129-491	R144	N16-R-88082-5267	R228	N17-B-77837-6875	E401
N16-C-72899-1028	L105	N16-R-50200-111	R130	N16-R-88342-5290	R140	N17-B-77940-6601	E106
N16-C-75785-4115	L401	N16-R-50236-111	R134	N16-R-88342-5291	R153	N17-B-77990-8876	E103
N16-C-76881-9658	L104	N16-R-50238-421	R105	N16-R-89652-5301	R167	N17-B-78034-2896	E102
N16-C-300798-452	H102	N16-R-50282-491	R110	N16-R-93082-3701	R229	N17-B-78115-8861	E101
N16-C-300798-621	H101	N16-R-50282-811	R115	N16-S-20881-7191	O116	N17-B-78212-3573	E104
N16-C-300798-866	H103	N16-R-50308-111	R239	N16-S-20884-2824	O141	N17-B-78252-8665	E105
N16-C-302438-869	O111	N16-R-50310-0480	R109	N16-S-20886-4321	O120	N17-C-48783-5435	W502
N16-C-599931-131	O110	N16-R-50373-231	R104	N16-S-20929-9498	O109	N17-C-66951-1201	W401
N16-C-99511-1007	N101	N16-R-50398-111	R133	N16-S-21061-6691	O118	N17-C-70335-9610	P103
N16-D-46353-7451	E302	N16-R-50399-811	R301	N16-S-34250-3862	E113	N17-C-70531-4965	P402
N16-F-32195-7693	Z106	N16-R-50443-111	R184	N16-S-34532-8725	E109	N17-C-70611-4968	P104
N16-G-431475-911	O108	N16-R-50515-111	R157	N16-S-34557-8350	E120		

TABLE 8-6. CROSS REFERENCE PARTS LIST—(Continued)

STANDARD NAVY STOCK NUMBER	KEY SYMBOL
N17-C-71416-2550	P101
N17-C-71423-6810	P301
N17-C-71426-7831	P106
N17-C-71458-5305	P302
N17-C-72263-4968	J104
N17-C-72611-9605	J103
N17-C-72627-4968	J402
N17-C-73112-1050	J105
N17-C-73114-7071	J101
N17-C-73412-2917	P105
N17-C-78538-5612	J403
N17-C-80686-6626	X132
N17-C-98373-2551	O132
N17-C-98378-4616	O401
N17-C-98378-8879	O402
N17-C-98431-7727	O101
N17-C-800645-401	E128
N17-C-813511-101	E152
N17-F-16302-120	F101
N17-F-74267-5401	X130
N17-G-47976-1245	G401
N17-G-150481-895	E408
N17-G-150537-738	E409
N17-G-154059-538	E415
N17-G-154151-471	E410
N17-G-154207-966	E414
N17-G-154348-840	E406
N17-G-163726-271	E405
N17-I-49277-2211	E305
N17-I-59792-6101	E426
N17-I-59792-7101	E434
N17-I-64417-2021	E130
N17-I-64417-2026	E131
N17-I-69172-6201	E107
N17-J-39248-4418	J102
N17-L-6297	I101
N17-L-6543-175	I102
N17-L-51632-6597	X131
N17-M-19052-1051	M301
N17-M-54490-2333	B401
N17-M-75068-3501	O143
N17-R-65555-2929	K401
N17-S-46668-8261	O126
N17-S-46679-3721	O112
N17-S-46711-8995	O137
N17-S-55304-4140	S101
N17-S-57687-8129	S104
N17-S-61052-5001	S301
N17-S-71351-9057	S102
N17-T-28227-4106	E149
N17-T-62599-2016	T103
N17-T-73951-9461	T102
N17-T-74308-7298	T101
N17-T-68062-2641	Z104
N17-T-68062-2643	Z102
N17-T-68062-2647	Z105
N17-T-68062-2662	Z101
N18-C-1597-3150	I301
N41-W-2460-1	H109
N43-S-16559-500	H402
N43-S-16665-3000	H110
N43-S-17333-1210	H111
N43-S-17340-2527	H112

SIGNAL CORP STOCK NUMBER	KEY SYMBOL
2A2060-6	A405
2A2546A/C2	O401
2A264-410-1	E445
2A288B-4	E421
2A288B-5	E417
2A288B-6	E425
2A326.2-10	A404
2A3393A.1-100	A401
2A3942-2	A301
2J0A3/VR75	V116
2J0C3/VR105	V115
2J1B3GT	V128
2J2C51	V103
2J3A5	V301
2J5CP1A	V127
2J5R4GY	V113
2J6AS6	V101
2J6Y6G	V112
2J5651	V125
2Z10008-134	E446
2Z1250.174	H107
2Z2636-26	H103
2Z2636-28	H102
2Z2712.1	E128
2Z2712.170	E152
2Z2935-95	O110
2Z307-112	O301
2Z3273-118	O132
2Z3273-217	O101
2Z3295-135	O402
2Z3351-208	A403
2Z3765-12	N102
2Z4868.769	E406
2Z4868.770	E408
2Z4868.771	E409
2Z4868.772	E410
2Z4868.773	E414
2Z4868.774	E415
2Z4868.775	E444
2Z4868.776	E405
2Z4878-1174	O108
2Z4878-1188	O103
2Z4878-1189	O105
2Z4885-218	W401
2Z5042-3	H101
2Z5091-87	A402
2Z5091-88	A101
2Z5822-44	E133
2Z5822-192	E124
2Z5822-443	E127
2Z5838	E303
2Z6195.19	O111
2Z6820-143	O143
2Z7390-52	W402
2Z7587-257	K401
2Z8204-179	O118
2Z8204-180	O141
2Z8204-181	O120
2Z8204-182	O116
2Z8204-184	O109
2Z8304.57	E113
2Z8304.123	E132
2Z8304.136	E109
2Z8320-13	E120
2Z8877.171	O112
2Z8877.364	O126
2Z8877.365	O137
2Z8996-26	O106
2Z9401.92	E153
2Z9612-229	T102
2Z9613.684	T101
2Z9629-247	L401
2Z9631.395	T103
2Z9634.108	Z106
2Z9634.138	T301
2Z9643.356	Z105
2Z9643.357	Z102
2Z9643.358	Z101
2Z9643.359	Z104
3C336-21	L106
3C336-158	L118
3C336-160	L105
3C1084C-45	L102
3C1084C-46	L101
3C575N-2	L107
3D9001E5-9	C403
3D9003V-20	C404
3D9005-85	C144
3D9005-116	C302
3D9010-63	C109
3D9015-119	C114
3D9015-130	C112
3D9022-49	C304
3D9034VE7	C111
3D9034VE7-1	C101A, B, C
3D9047-23	C102
3D9095V-5	C401A, B, C, D, E, F
3D9330-24	C162
3D9470-38	C103
3D9500-189	C305
3DA50-172	C142
3DA100-735	C181A, B
3DA200-63	C133
3DB1-195	C175
3DB3-20	C405
3DB4-282	C172
3E6015-92A	W501
3E7350.1-141	W503

TABLE 8–6. CROSS REFERENCE PARTS LIST—(Continued)

SIGNAL CORP STOCK NUMBER	KEY SYMBOL	SIGNAL CORP STOCK NUMBER	KEY SYMBOL	IBM SERIAL NUMBER	KEY SYMBOL	IBM SERIAL NUMBER	KEY SYMBOL
3E7350.1–1193	W502	3RC20BF273K	R301	110150	J401	067150203	R182
3F30825–1	I301	3RC20BF682J	R130	150400	J403	080150020	E302
3F872–1	M301	3RC20BF751J	R303	195270	P105	080550060	N101
3G320–158	E131	3RC30BF104J	R150	230998	P106	081550010	E305
3G320–159	E130	3RC30BF152K	R201	263180	P302	082740040	E426
3G350–111	E107	3RC30BF223K	R104	265115	P301	082740050	E434
3H3000–173	B401	3RC30BF224K	R229	278453–52	P103	202161422	E445
3K2033032	C143	3RC30BF334K	R227	320500–52	P402	202599479	E421
3K2056033	C137	3RC30BF472J	R217	323860–52	P104	202599480	E417
3K2062033	C115	3RC30BF683J	R221	361212	F101	202599481	E425
3K3510224	C170	3RC30BF823K	R233	444065	I102	203131912	A404
3K3547224	C118	3RC42BF154K	R235	444163	I101	204024684	A405
3K3568211	C160	3RC42BF123K	R109	467460	P101	204751110	O401
3K3582222	C157	3RC42BF224K	R161	482625	J105	205297146	A401
3RA910	R167	3RC42BF334K	R162	538625–52	J103	205526010	A301
3RC10BF100K	R111	3RC42BF683K	R178	563880–52	J104	233321060	A233
3RC10BF101J	R241	3RC42BF822K	R105	566042–52	J402	234005500	V116
3RC10BF103K	R110	3RW24359	R164	619703	X130	234006500	V115
3RC10BF104J	R158	3Z770–1.16	E402	732555–4	H110	234024580	V128
3RC10BF104K	R101	3Z770–6.73	E139	732600	H111	234190475	V103
3RC10BF105J	R129	3Z770–8.66	E401	732602	H112	234220000	V301
3RC10BF105K	R102	3Z770–10.45	E106	732899–5	H403	234330002	V127
3RC10BF122K	R113	3Z770–14.49	E102	736160	H402	234355000	V113
3RC10BF123J	R239	3Z770–15.12	E103	749430	J102	234454100	V101
3RC10BF154K	R154	3Z770–28.16	E104	776598	X131	234820000	V112
3RC10BF184K	R232	3Z770–36.19	E105	859441	H109	235793280	V125
3RC10BF221K	R106	3Z3275	X130	859500	H405	286054694	O301
3RC10BF224J	R142	3Z6925–2.1	R238	883600	X101	286393635	H107
3RC10BF271K	R108	3Z7325–46	R172	891980	X112	287172845	H103
3RC10BF272K	R149	3Z7325–47	R151	896279	X103	287172860	H101
3RC10BF274K	R213	3Z7425–89	R132	897615	X127	287222500	E128
3RC10BF334K	R119	3Z7425–90	R193	015086350	E301	287222714	E152
3RC10BF392K	R156	3Z7425–91	R222	017243000	O136	287267767	O110
3RC10BF393J	R184	3Z7450–138	R230	017243020	O115	287658935	O101
3RC10BF471K	R137	3Z7450–139	R191	017243040	O104	287696164	O402
3RC10BF472J	R181	3Z7498–25.90	R228	017247040	E45A	287720662	A403
3RC10BF472K	R144	3Z7499–1.118	R153	018481000	E450	290703152	A101
3RC10BF560K	R405	3Z7499–1.119	R140	018782200	E151	291456778	N102
3RC10BF563J	R157	3Z9509–1	S104	028700015	A102	291618213	E406
3RC10BF683K	R141	3Z9580–16.2	S101	057250100	C308	291618214	E408
3RC10BF822J	R134	3Z9825–65.71	S301	060701200	L302	291618215	E409
3RC20BF103K	R115	3Z9863–10A	S102	060701210	L301	291618216	E410
3RC20BF104K	R302	3Z12041–3.3	E149	067110206	R199	291618217	E414
				067125302	R170	291618218	E415

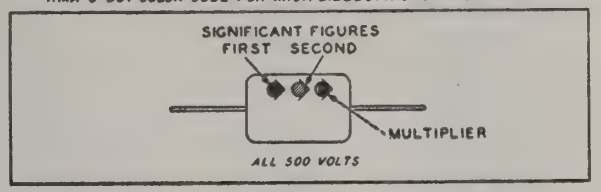
TABLE 8–6. CROSS REFERENCE PARTS LIST—(Continued)

IBM SERIAL NUMBER	KEY SYMBOL	IBM SERIAL NUMBER	KEY SYMBOL	IBM SERIAL NUMBER	KEY SYMBOL	IBM SERIAL NUMBER	KEY SYMBOL
291618219	E444	298300918	O132	331265915	E107	381166220	R302
291618220	E405	298362036	O143	373734276	B401	381168540	R301
291632802	O108	299442704	O112	376024210	C143	381316000	R150
291632816	O103	307764000	L106	376039200	C137	381316160	R109
291632817	O105	307768808	L118	376040000	C115	381317080	R201
291643517	W401	307768810	L105	376143494	C170	381318120	R104
291697087	H101	308412536	L102	376151200	C118	381318180	R229
291703151	A402	308412537	L101	376155520	C160	381319020	R227
292241364	E124	309600000	E403	376158450	C157	381319720	R217
292241615	E127	310006057	L107	380009100	R167	381320620	R221
292241616	E133	312706100	C403	381015980	R111	381602006	R235
292266000	E303	312794144	C404	381016000	R241	381603269	R161
292597578	O111	312860687	C144	381016160	R110	381604337	R162
294732317	W402	312860718	C302	381016200	R158	381604669	R105
294797866	K401	313004520	C109	381016220	R101	385243590	R164
295559990	O118	313090657	C114	381016260	R129	387256017	E402
295559991	O141	313090668	C112	381016280	R102	387256423	E139
295559992	O120	313174267	C304	381016620	R113	387256567	E401
295559993	O116	313343860	C111	381016640	R239	387256695	E106
295559995	O109	313343861	C101A, B, C	381017660	R126	387256992	E103
295580677	E120	313430240	C102	381017680	R232	387257646	E104
295578675	E113	313624041	C401A, B,	381018000	R106	387257809	E105
295578946	E132		C, D, E, F	381018160	R142	394184101	R238
295578959	E109	314328093	C162	381018460	R108	394362087	R172
296470130	O137	314430224	C103	381018500	R149	394362088	R151
296470138	O126	314693459	C305	381018520	R133	394384126	R132
296476000	O106	316163255	C142	381018580	R213	394384127	R193
296619227	E153	316562528	C133	381019020	R119	394384128	R222
296889169	T102	316777660	C181A, B	381019340	R156	395006000	S104
296912620	T101	316958819	C175	381019360	R184	395500818	S301
296950747	L401	317126015	C405	381019680	R137	395050427	S101
296950748	L104	317643024	C172	381019720	R181	395852376	S102
296979215	T103	322850471	W501	381019740	R144	396321871	E149
297031771	Z106	322853218	W503	381020100	R405	399650169	E102
297031801	T301	322863255	W502	381020200	R157	399809083	R230
297070069	Z105	325228040	M301	381020560	R130	399809084	R191
297070070	Z102	328550884	I301	381020640	R141	399811570	R228
297070071	Z101	331017200	R154	381021000	R134	399812108	R153
297070072	Z104	331250759	E131	381166160	R115	399812109	R140
297779781	E446	331250760	E130				

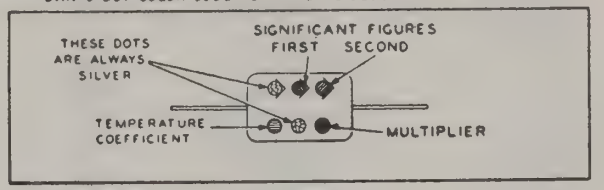
TABLE 8–7. APPLICABLE COLOR CODES AND MISCELLANEOUS DATA

CAPACITOR COLOR CODES

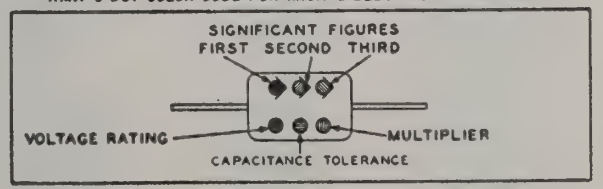
RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



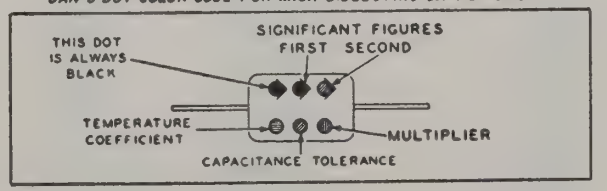
JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



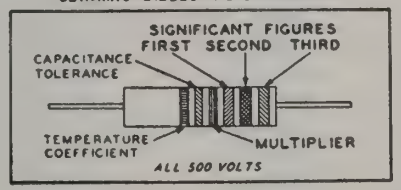
RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

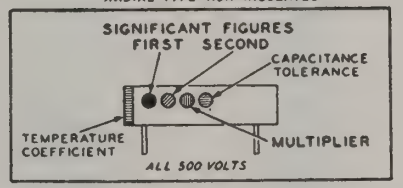


RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS

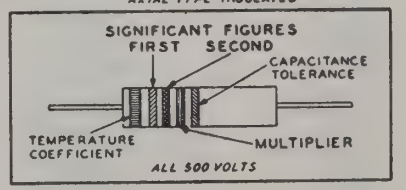


JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS

RADIAL TYPE NON-INSULATED



AXIAL TYPE INSULATED



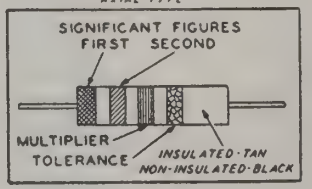
RMA: RADIO MANUFACTURERS ASSOCIATION
JAN: JOINT ARMY-NAVY

RESISTORS		CAPACITORS						
				MULTIPLIER				
TOLERANCE	MULTIPLIER	SIGNIFICANT FIGURE	COLOR	RMA MICA AND CERAMIC-DIELECTRIC	JAN MICA AND PAPER-DIELECTRIC	JAN CERAMIC DIELECTRIC	VOLTAGE RATING	TEMPERATURE COEFFICIENT
	1	0	BLACK	1	1	1		A
	10	1	BROWN	10	10	10	100	B
	100	2	RED	100	100	100	200	C
	1,000	3	ORANGE	1,000	1000	1000	300	D
	10,000	4	YELLOW	10,000			400	E
	100,000	5	GREEN	100,000			500	F
	1,000,000	6	BLUE	1,000,000			600	G
	10,000,000	7	VIOLET	10,000,000			700	
	100,000,000	8	GRAY	100,000,000		0.01	800	
	1,000,000,000	9	WHITE	1,000,000,000		0.1	900	
5	0.1		GOLD	0.1	0.1		1000	
10	0.01		SILVER	0.01	0.01		2000	
20			NO COLOR				500	

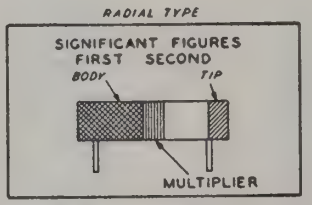
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE

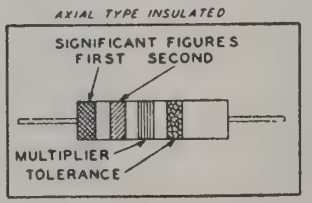


RADIAL TYPE



JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE INSULATED



RADIAL TYPE NON-INSULATED

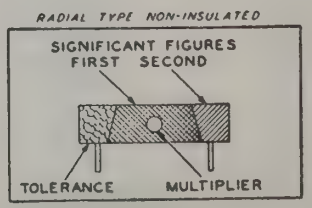


TABLE 8–8. LIST OF MANUFACTURERS

ABBREVIATION	PREFIX	NAME	ADDRESS
AB	CBZ	Allen-Bradley Co.	118 W. Greenfield Ave. Milwaukee, Wisconsin
AH&H	CHH	Arrow-Hart & Hegeman Elec. Co.	102 Hawthorne St. Hartford, Connecticut
Amer Rad Hdwe	CNH	American Radio Hardware Co. Inc.	476 Broadway New York, N.Y.
Amperite	CAGK	Amperite Company	561 Broadway New York, N.Y.
Amphenol	CPH	American Phenolic Corp.	1830 S. Fifty-fourth Ave. Chicago, Illinois
Bendix	CRR	Bendix Radio—Div. of Bendix Aviation	E. Joppa Rd. Towson 4, Maryland
Birtcher	CAIS	The Birtcher Corp.	5087 Huntington Drive Los Angeles 32, California
Bristolco	CTB	Bristol Co.	117 Bristol Rd. Waterbury, Connecticut
Corning Glass	CBI	Corning Glass Works	1943 Crystal St. Corning, N. Y.
Cinch	CMG	Cinch Mfg. Co.	2339 W. Van Buren St. Chicago, Illinois
ELCO Resist	CAVT	Elco Resistor Co.	114 W. 18th St. New York, N.Y.
Elec Indicator	CAIB	Electric Indicator Co.	23 Parker Ave. Stamford, Connecticut
Electro-Motive	CMF	Electro-Motive Mfg. Co.	Willimantic, Connecticut
Erie	CER	Erie Resistor Corp.	644 W. 12th St. Erie, Pennsylvania
GE	CG	General Electric Co.	1 River Rd. Schenectady 5, New York
Hubbell	CHU	Harvey Hubbell Inc.	447 Concord Ave. Bridgeport, Connecticut
INCCO	CIE	Industrial Condenser Corp.	1725 W. North Ave. Chicago 22, Illinois
Isolantite	CBU	Isolantite Inc.	343 Courtland St. Belleville, New Jersey
Jeffers Electronics	CAUZ	Jeffers Electronics	Dubois, Pennsylvania
JFD	CDJ	JFD Mfg. Co.	4111 Fort Hamilton Pkwy. Brooklyn, New York
Johnson E.F.	CEJ	E.F. Johnson Co.	Waseca, Minnesota
K&E Co.	CBIO	Keuffel & Esser Co.	Hoboken, New Jersey
Kellogg	CKG	Kellogg Switchboard & Supply Co.	6605 So. Cicero Ave. Chicago, Illinois
Kurz-Kasch	CAUP	Kurz-Kasch Inc.	1421 S. Broadway Dayton, Ohio
L.N. Barry	CAYU	The Barry Corp.	179 Sidney St. Cambridge, Massachusetts
Littelfuse	CLF	Littelfuse, Inc.	4765 Ravenswood Ave. Chicago 40, Illinois
Lord	CAXP	Lord Mfg.	1639 W. 12th St. Erie, Pennsylvania
Millen	CJA	James Millen Mfg. Co. Inc.	150 Exchange St. Malden, Massachusetts
Nat'l Co.	CNA	National Company, Inc.	61 Sherman St. Malden, Massachusetts
Oak	COC	Oak Mfg. Co.	1200 N. Clybourne Ave. Chicago, Illinois
Price Electric	CPB	Price Electric Corp.	332 E. Church & 2nd St. Frederick, Maryland
RCC	CRK	Radio Condenser Co.	Camden, New Jersey
Tobe	CTD	Tobe-Deutschmann Corp.	921 Providence Highway Norwood, Massachusetts
Ward Prod	CWA	Ward Products Co.	1523 E. 45th St. Cleveland, Ohio

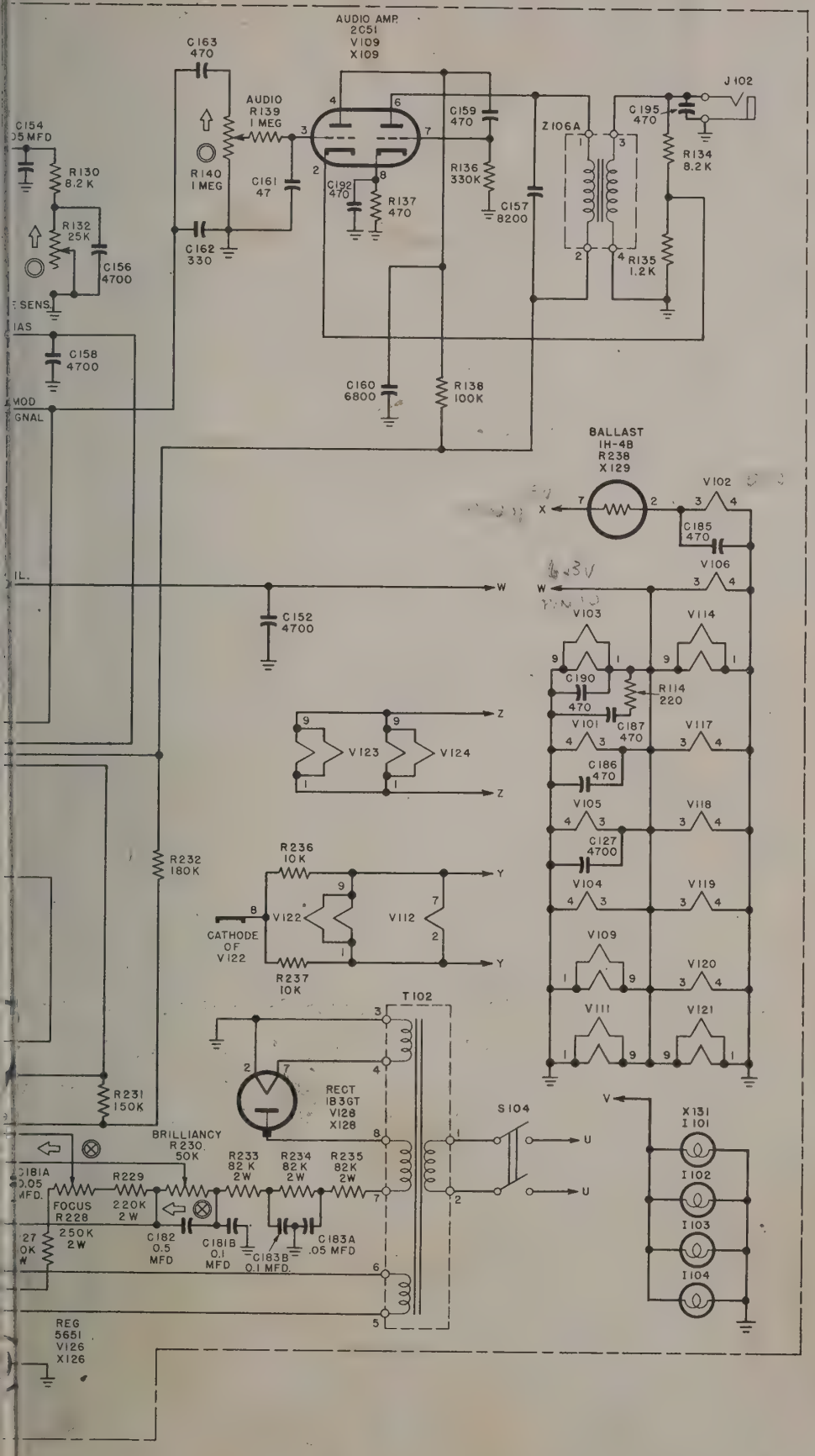


Figure 7-13. Radio Direction Finder Set AN/URD-2, Schematic Diagram

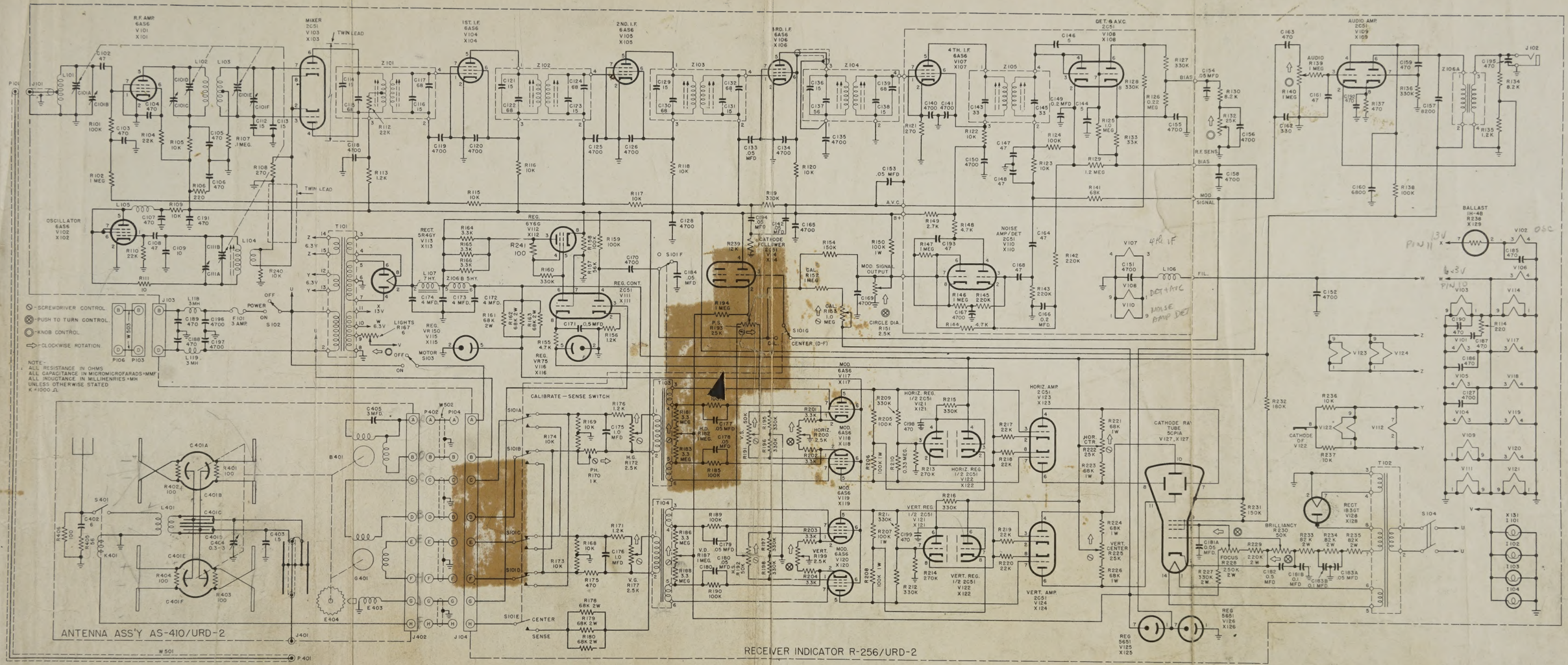


Figure 7-13. Radio Direction Finder Set AN/URD-2, Schematic Diagram

R184